

PROCRASTINATION, STRESS, AND SLEEP IN TERTIARY STUDENTS

A thesis submitted in partial fulfilment of the requirements for the degree of
Master of Science in Psychology

by Nikita Marie Dow

Department of Psychology, University of Canterbury 2018

Abstract

The current study aimed to investigate the relationships between procrastination, sleep and stress using a variety of state, trait and pseudo-behavioural measures across multiple time points. Fifty-four tertiary students at a New Zealand university answered several questionnaires pertaining to their experiences of perceived stress, overall sleep quality and procrastination before downloading the Sleep and Procrastination Application (SPA), recording their habits for two weeks and finally retaking the initial questionnaires. Results showed associations across different measurement methods for all three constructs with cross-method measures of stress being the most reliable and cross-method measures of sleep having the fewest number of intra-associations. Additionally, the self-reported state procrastination measure proved to be the procrastination measurement method with the greatest number of cross-concept correlations. Finally, mediation analyses revealed that perceived stress at Time 2 significantly mediates the relationship between trait procrastination and Time 2 overall sleep quality. However, several other procrastination, sleep and stress mediation models were also shown to be significant. The relationship between procrastination, stress and sleep appears complicated but the results of this study add to the extant literature and provide direction for future research.

Acknowledgements

The completion of this thesis would not have been possible without the support of my friends, family and the fantastic staff at the University of Canterbury. I would especially like to acknowledge the efforts of my programmer, Mitchell Winder, who volunteered a large portion of his time to work with me on the Sleep and Procrastination Application. Words cannot express the extent of my gratitude for the many hours he spent coding, bug fixing and troubleshooting my application. Secondly, I would like to thank the Clinical staff at the Psychology Centre for being understanding and accommodating of my dual commitments. Finally, I would like to thank my supervisors Roeline Kuijer and Anthony McLean for their feedback and guidance throughout this process.

Table of Contents

Abstract.....	i
Acknowledgements.....	ii
List of Figures.....	v
List of Tables.....	iv
Introduction.....	2
Defining Procrastination.....	2
Procrastination in Student Populations.....	3
The Possible Impacts of Procrastination.....	4
Procrastination, Sleep and Stress.....	6
Measures of Procrastination.....	10
Current Research.....	14
Method.....	16
Participants.....	16
Measures.....	16
Procedure.....	21
Data Analysis.....	23
Results.....	26
Descriptive Statistics.....	26
Associations Between Self-report and Pseudo-behavioural Measures.....	28
Associations Between Procrastination, Sleep and Stress.....	29
Mediation Analyses.....	33
Discussion.....	38
Associations Between Self-report and Pseudo-behavioural Measures.....	38
Associations Between Procrastination, Sleep and Stress.....	40

Mediation Models.....	42
Limitations and Future Research.....	44
Concluding Remarks.....	46
References.....	47
Appendices.....	55
Appendix A: Advertisement for Participant Recruitment.....	55
Appendix B: Questionnaires.....	56
<i>B-1 Demographic Questions.....</i>	<i>56</i>
<i>B-2 Pure Procrastination Scale.....</i>	<i>57</i>
<i>B-3 Academic Procrastination State Inventory.....</i>	<i>58</i>
<i>B-4 Pittsburgh Sleep Quality Index.....</i>	<i>59</i>
<i>B-5 Perceived Stress Scale.....</i>	<i>61</i>
Appendix C: Sleep and Procrastination App Screenshots.....	62
Appendix D: Letter of Approval from the Human Ethics Committee.....	66
Appendix E: Participant Resources.....	67
<i>E-1 Information Sheet.....</i>	<i>67</i>
<i>E-2 Consent Form.....</i>	<i>69</i>
<i>E-3 Debriefing Sheet.....</i>	<i>70</i>
<i>E-4 App Information Sheet.....</i>	<i>71</i>

List of Figures

Figure 1: Example mediation model for the relationship between the predictor variable and criterion variable as mediated by the mediator variable.....21

Figure 2: Standardized regression coefficients for the relationship between Trait procrastination (as measured by the Pure Procrastination Scale) and overall sleep quality (as measured by the Pittsburgh Sleep Quality Index) at Time 2 as mediated by perceived stress (as measured by the Perceived Stress Scale) at Time 2.....33

List of Tables

Table 1: Descriptive Statistics.....	27
Table 2: Correlation Matrix of Procrastination, Sleep and Stress Measure.....	31
Table 3: Results of All Mediation Analyses.....	35

Procrastination, Stress, and Sleep in Tertiary Students

Many academics and laymen alike have experienced the dreadful stress and guilt that so often follows procrastinating on an important task. However, for some, procrastination is more than a mild nuisance, but rather a severe and chronic problem that affects multiple facets of their life. It is important that the correlates and underlying factors of procrastination are examined so that effective treatment strategies and preventative measures can be developed.

Defining Procrastination

Before procrastination can be measured, it must first be defined. An early etymological dictionary written in 1884 described procrastination as being of Latin origin, with *pro-* meaning “forward, hence, off” and *-crastinus* meaning “put off till the morrow, belonging to the morrow.” and defined the verb *procrastinate* as “to postpone, delay” (Skeat, 1884, pg. 468). However, as with all commonly used words, the meaning of *procrastination* has subtly shifted over time. Thus it has befallen researchers to design a clear definition for the concept of procrastination.

There have been many attempts in the literature to succinctly describe this concept. For example, Solomon and Rothblum, (1984) viewed procrastination as being “the act of needlessly delaying tasks to the point of experiencing subjective discomfort...” (pg. 503). Lay (1986) described procrastination with a different emphasis as “the tendency to postpone that which is necessary to reach some goal.” (pg. 475). Adding to this, Van Eerde (2000) noted that “...procrastination involves the avoidance of the implementation of an intention” (pg. 374).

While these definitions individually covered the core features of procrastination (delayed action, irrationality, known consequences, and intention), the present study will use

the definition proposed by Steel (2007) who combined the core concepts of previous definitions to provide the following working definition of procrastination: "...to procrastinate is to voluntarily delay an intended course of action despite expecting to be worse off for the delay." (pg. 66).

The concept of procrastination can be further divided into state and trait procrastination. *State procrastination* reflects the circumstance-dependent and fluctuating day to day occurrences of procrastination. Meanwhile, *Trait procrastination* indicates the existence of stable individual differences in the tendency to procrastinate over long periods of time. Most procrastination measures have viewed procrastination as an enduring trait; however, some have argued for the relevance of measuring state procrastination (Schouwenburg, 1995).

Procrastination in Student Populations

Procrastination is a prevalent and significant problem in the modern day, especially with students. While approximately 20% of adults report chronic and problematic procrastination, (Ferrari, O'Callaghan, & Newbegin, 2005; Harriott & Ferrari, 1996) this can be anywhere from 30% to almost 50% in student populations (Day, Mensink, & O'Sullivan, 2000; Onwuegbuzie, 2000; Solomon & Rothblum, 1984). In one study, 39.3% of graduate students reported that they nearly always or always procrastinated studying for examinations, 41.7% reportedly procrastinated the same amount on writing term papers, and 60% on their weekly reading assignments (Onwuegbuzie, 2000). The amount of time spent procrastinating by students is considerable with one study reporting that procrastination comprised, on average, over one third of student's daily activities (Pychyl, Lee, Thibodeau, & Blunt, 2000). A 1984 study by Solomon and Rothblum found that 65% of students desired to reduce their

procrastination when writing papers, 62% wanted to procrastinate less when studying for exams and 55% indicated the same for their weekly assignments.

While it has been shown that procrastination decreases with age, it may conversely, be increasing by year of publication (Steel, 2007). According, to Steel (2007) the year of publication had a significant effect on the amount of procrastination (after the different procrastination measures were controlled for) from 1982 until 2003. While it is unclear if modern day students are truly greater procrastinators, in a recent study by Pinyerd (2013), 34% of students reported that social media sites such as Instagram and YouTube encouraged them to procrastinate. Other studies have found associations between procrastination and problematic Facebook use (Meier, Reinecke, & Meltzer, 2016; Przepiorka, Błachnio, & Díaz-Morales, 2016) as well as an association between procrastination and problematic internet use in general (Thatcher, Wretschko, & Fridjhon, 2008). Given that 45% of modern day college students reportedly spend 6 - 8 hours each day checking social media sites, with only 12% reporting less than 2 hours of social media time (Wang, Chen, & Liang, 2011), it would not be surprising to find that they are indeed procrastinating more than the students of the past. Regardless, it is clear that procrastination is a significant problem in the modern day with a high prevalence and intensity in student populations.

The Possible Impacts of Procrastination

Academic.

Results of a meta-analysis conducted by Steel (2007) of 141 journal articles and 53 theses suggested that there is a weak but consistently negative relationship between procrastination and overall academic performance. More specifically, procrastination was consistently shown to have negative correlations with course GPA, overall GPA, assignment grades and final exam scores (Steel, 2007). This is supported by the findings of Tice, and

Baumeister, (1997) who reported that more than one-third of the variation in final exam scores could be attributed to procrastination.

For some students, the consequences of procrastination are so great that they turn to academic misconduct to bolster their grades. Indeed, procrastination has been found to be positively correlated with several kinds of academic misconduct (Ferrari, Keane, Wolfe, & Beck, 1998; Roig and DeTommaso, 1995). One study by Patrzek, Sattler, van Veen, Grunschel, and Fries (2014) found that, when the factor score of academic procrastination increased by 1, there was a 68% increase in the frequency of false excuses and medical certificates to postpone an exam or extend a deadline.

Occupational.

Looking at the financial correlates of procrastination, a study by Mehrabian (2000), examined peer-reported success and found a significant negative correlation between career/financial success and trait procrastination. Later Nguyen, Steel, and Ferrari (2013) found that procrastination was significantly associated with lower income (especially in men) and higher unemployment. They noted that, with each point increase on their trait procrastination measure, there was, on average, an approximately \$15,000 drop in salary and 322 fewer days of employment.

Physical health.

Studies on the self-reported impact of procrastination on health have found significant correlations between trait procrastination and treatment delay, poorer health, fewer wellness behaviours, and reduced intention to engage in health behaviours (Sirois, 2004; Sirois, Melia-Gordon, & Pychyl, 2003). Various studies have shown that procrastinators tend to procrastinate on going to the doctors and postpone getting appropriate medical treatments or diagnostic tests, potentially leading to severe consequences (Colman, Brod, Potter, Buesching, & Rowland, 2004; Morris, Menashe, Anderson, Malinow, & Illingworth, 1990;

White, Wearing, & Hill, 1994). Tice and Baumeister (1997) found that, although procrastinators reported significantly less physical illness than non-procrastinators when academic deadlines were distant, this changed as deadlines approached. In the end procrastinators reported more symptoms of physical illness, and more medical visits, to the degree that, overall, procrastinators suffered more health problems than non-procrastinators. Procrastination has also been linked to taking more work breaks due to tiredness (Strongman & Burt, 2000), lower energy levels (Kachgal, Hansen, & Nutter, 2001) and poorer sleep quality (Kühnel, Bledow, & Feuerhahn, 2016).

Mental health.

Similar findings have been found regarding mental health, with higher procrastination scores predicting both poorer mental health and fewer mental health help-seeking behaviours (Stead, Shanahan, & Neufeld, 2010). More specifically, procrastination has been found to be associated with a number of negative psychological symptoms, such as: low self-esteem (Ferrari, 1991), low self-efficacy (Klassen, Krawchuk, & Rajani, 2008), feelings of shame (Fee & Tangney, 2000), maladaptive coping strategies (Sirois and Kitner, 2015), ADHD inattention symptoms (Niermann, & Scheres, 2014), anxiety (Haycock, McCarthy, & Skay, 1998), and depression (Saddler, & Sacks, 1993; Steel, 2007).

Procrastination, Stress, and Sleep

As described above, procrastination has been associated with a variety of negative long-term outcomes. However, recently researchers have become increasingly interested in the relationships between procrastination and stress, as well as procrastination and health outcomes. While many studies have investigated the links between procrastination and a variety of health outcome indices (Sirois, 2007; Sirois et al., 2003), few have examined the relationship between procrastination and sleep. This is despite problems with procrastination

and sleep both being prevalent in student populations (Day, Mensink, & O'Sullivan, 2000; Buboltz, Brown, & Soper, 2001).

A recent study by Hairston, and Shpitalni, (2016) indicated that sleep may be associated with trait procrastination and that chronotype (a behavioural manifestation of underlying sleep preferences based on the circadian rhythm) may play an important role in this relationship. They found that procrastination was positively associated with sleep disturbances in self-identified "Intermediate" and "Evening" chronotypes, but not "Morning" types, and that this relationship was mediated by negative mood and rumination. Supporting these findings, a study by Digdon, and Howell (2008) found that eveningness was associated with poorer self-regulation in Canadian college students.

Notably, college-aged students are more likely to have evening chronotypes and a preference for later bedtimes (Koskenvuo, Hublin, Partinen, Heikkilä, & Kaprio, 2007); and when this preference for late sleep times is combined with the early wake times demanded by university class schedules, "social sleep lag" naturally occurs (Kühnel, Bledow, & Feuerhahn, 2016). *Social sleep lag* is when an individual's chronotype does not align with their work schedule, leading to ongoing mild sleep deprivation (Kühnel et al., 2016). In their study, Kühnel and colleagues hypothesized that those who reported poorer quality sleep and less sleep would procrastinate more, with this relationship being mediated by social sleep lag. After conducting a multilevel analysis they concluded that when sleep quality was low, social sleep lag increased state procrastination. Additionally, higher sleep quality was associated with less procrastination; however, the specific sleep duration of any given day was not found to be related to state procrastination. These studies suggest that there is a link between procrastination and sleep that warrants further investigation.

There is also a well-established relationship between stress and sleep (Lund, Reider, Whiting, & Prichard, 2010; Morin, Rodrigue, & Ivers, 2003; Sadeh, Keinan, & Daon, 2004),

and between stress and procrastination (Sirois and Pychyl, 2013). Student procrastinators have been found to experience more overall stress than their non-procrastinator peers, especially right before their end of year deadlines (Tice & Baumeister, 1997). However, they report less stress than non-procrastinators when deadlines are distant (Tice & Baumeister, 1997).

An model put forth by Sirois and Pychyl (2013) explains this phenomenon by viewing procrastination as a coping mechanism for the stress and negative moods caused by aversive tasks. Their explanation posits that if a task is particularly aversive or has a very distant reward; negative emotions such as stress may be experienced in relation to said task, affecting motivation for task engagement. Following this, procrastination works as a kind of short term mood repair; alleviating short term stress and emotional discomfort by means of avoidance. However, this avoidance-based coping strategy then results in worse stress and mood in the long-term (Mayers, 1946; Solomon & Rothblum, 1984), and seemingly perpetuates procrastination behaviours, creating a performance spiral (Lindsley, Brass, & Thomas, 1995; Sirois and Pychyl, 2013).

Supporting this explanation, a factor analysis of the Procrastination Assessment Scale–Students (which investigates students’ reasons for procrastinating on academic assignments) found that the reasons that accounted for the greatest degree of variance in procrastination were “fear of failure” and “task aversiveness” (Solomon & Rothblum, 1984). Likewise, negative feelings (such as stress and anxiety) towards a specific task (Blunt & Pychyl, 2000; McCown, Blake, & Keiser, 2012), and the recognition of previous procrastination appear to increase both stress (Lay, 1994) and future procrastination (Tykocinski & Pittman, 1998). Additionally, a meta-analysis by Sirois and Kitner (2015) found that trait procrastination was positively associated with maladaptive coping strategies; and an analysis by McCown, Johnson, and Petzel (1989) found that diminished feelings of

control over the current situation, depressed affect and neuroticism tended to load together in trait procrastinators. Another meta-analysis by Steel (2007) concluded that, the more procrastinators consider a task to be effortful, anxiety provoking or unpleasant, the more they procrastinate. Other studies have found that procrastination predicts later increased stress (Sirois & Tosti, 2012; Sirois, 2014) and negative affect (Stainton, Lay, & Flett, 2000). Moreover, reducing negative feelings towards past procrastinating has been shown to be useful in reducing future procrastination (Wohl, Pychyl, & Bennett, 2010).

While there is a well-supported association between procrastination and stress (Sirois & Pychyl, 2013), and emerging evidence for a relationship between procrastination and sleep (Hairston, Shpitalni, 2016; Kühnel et al., 2016); a search of Google Scholar, PubMed and PsycINFO yielded only one paper that examined all three of these variables together. A study by Sirois, van Eerde, and Argiropoulou (2015) examined data from 339 Canadian undergraduate psychology students who completed an online survey for course credit which included a Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, and Kupfer, 1989), a Perceived Stress Scale (PSS; Cohen, Kamarck, and Mermelstein, 1983) and a General Procrastination Scale (GPS, Lay, 1986). In their analyses, they found that there was a significant indirect effect of trait procrastination on overall sleep quality through perceived stress. Moreover, when perceived stress was controlled for, there was no longer a significant direct effect between trait procrastination and overall sleep quality, indicating that perceived stress explained a substantial proportion of this relationship. The effects of trait procrastination on sleep quality through perceived stress were found to be moderate and significant using a bootstrapping procedure. However, the model was only able to account for 7% of the variance in PSQI scores, and direction of this relationship could not be inferred due to this study's cross-sectional design. Nonetheless, Sirois and colleagues (2015) provided

preliminary support for stress as a mediator of the procrastination–sleep relationship and highlighted a need for additional research into the associations between these three factors.

Measures of Procrastination

The majority of the research on procrastination has been completed using self-report trait procrastination questionnaires. However, some contend that such instruments do not adequately reflect the actual behaviours of procrastinators and note that the scores on various procrastination scales may be tainted by self-concept (Steel, Brothen, & Wambach, 2001). Likewise, memory biases may also have an effect on both state and trait procrastination questionnaire measures. Few studies in the literature have used behavioural measures or pseudo-behavioural measures to examine state procrastination; those that have are reviewed below.

The first researchers to use behavioural measures appear to be Solomon and Rothblum (1984). These authors studied students in an introductory psychology course who were given self-paced quizzes related to their textbook chapters and asked to participate in one of three experimental sessions which occurred at given dates across a semester. Students were considered to be greater procrastinators if they did more of these self-paced quizzes during the last third of the semester and attended the last available experimental session (which occurred in the final week of the semester). These behavioral measures were compared to the Procrastination Assessment Scale–Students (PASS, Solomon & Rothblum, 1984). While positive correlations were found between the number of quizzes completed in the last third of the semester and self-reported procrastination on writing term papers, studying for exams, and doing weekly readings; these were only weakly correlated. Moreover, while participants who attended the late experimental session reportedly procrastinated on administrative tasks significantly more than participants from earlier

sessions, this was not found for the other domains of the PASS (writing term papers, studying for an exams, keeping up with weekly reading assignments, attending meetings, and performing academic tasks in general). The results of this study suggest that Solomon and Rothblum's behavioural measures of procrastination may have been measuring something different to the self-reported trait procrastination measure used in this study.

Steel and colleagues (2001) also conducted a study with behavioural measures. Using a computer-administered personalized system of instruction (PSI) the researchers were able to record the study habits of 152 undergraduate students. Students could independently complete computerized vocabulary exercises, read course-related text, write answers to study questions and complete digital practise tests using this system. Participants were also required to use the PSI to take computerized chapter quizzes which affected their grade. *Observed procrastination* scores were a combination of *postponement* (a weighted average based on when each quiz was completed) and *irrationality* (the number of vocabulary exercises not completed). Results showed that the observed measures of overall procrastination and postponement were weakly correlated with their equivalent self-reported measures. However, the observed irrationality measure was not significantly correlated with its self-reported equivalent. Additionally, the various observed procrastination measures better predicted the performance outcome measures (such as the overall course grade, and final exam grade) than the equivalent self-reported measures. Conversely, the self-reported measures better predicted affect and negative mood across the four time points. Steel and colleagues noted that this result may potentially be due to a tendency for self-reported procrastinators to retrospectively negatively evaluate their behavior.

Similar to Steel and colleagues, Moon and Illingworth (2005) used digitally administered tests for an introductory psychology course as a measure of behavioural procrastination. Participants were granted a 1-week window to take each test and their

behavioural procrastination was calculated based on the delay between when each test became available and when the participant actually took the test. This behavioural measure was compared to the Aitken Procrastination Inventory (API; Aitken, 1982), a trait procrastination measure, as well as measures of conscientiousness, neuroticism and class test performance. Latent growth curve modeling showed that, while behavioural measures of procrastination were negatively related to test performance, self-report measures did not predict temporal changes in test performance over time. Additionally, those classified as high trait procrastinators were found to have the same behavioural trajectory over time as low trait procrastinators. Moreover, behavioural measures of procrastination significantly predicted test scores at all time points. These results lead the researchers to conclude that the utility of self-report trait-based measures of procrastination as assessments of procrastinatory behaviour was questionable and required further research.

DeWitte and Schouwenburg (2002) took a different approach, highlighting the intention–action gap aspect of procrastination. In their study they recorded the procrastination habits of 21 psychology students across 10 weeks. Each week students were asked how many hours they intended to study in the next week and how many hours they had actually studied in the past week. The difference between these values was used to calculate a pseudo-behavioural measure of procrastination. Notably, no significant association was found between their pseudo-behavioural measure of procrastination and self-reported trait procrastination.

A more recent study by Krause and Freund (2014) noted that behavioural measures of procrastination were necessarily state measures of procrastination and thus should be compared to state-based self-report measures. They compared self-reported state procrastination over time with a similar pseudo-behavioural measure to that used in DeWitte and Schouwenburg's (2002) study to determine which measure was a better predictor of

affective well-being. The authors asked students to report how many minutes they had intended to study during the previous 24 hours and how minutes they actually studied in this time period. The difference between these values, once again, was used to calculate a pseudo-behavioural measure of procrastination and was compared to the Academic Procrastination State Inventory (APSI; Schouwenburg, 1995). The authors found that their pseudo-behavioural measure of procrastination was moderately correlated with self-reported state procrastination over time. However, only self-reported state procrastination was negatively associated with affective well-being. The authors concluded that their results supported the use of self-reported state measures of procrastination.

Most of the research comparing behavioural measures of procrastination with self-reported procrastination have found either relatively small or non-significant associations between behavioural measures of procrastination and self-report measures. Moreover, these previous studies have mostly found that behavioural measures are more strongly associated with academic achievement and similar outcomes than trait measures. As noted by Krause and Freund (2014), this lack of an association between behavioural measures of procrastination and self-report measures may simply reflect the fact that behavioural measures of procrastination are inherently state measures. Indeed, when a pseudo-behavioural measure was compared to a state procrastination measure, the two measures were found to be correlated. The pseudo-behavioural measures used in DeWitte and Schouwenburg (2002); and Krause and Freund (2014) provide an interesting more behavioural alternative to standard self-report measures, while also incorporating a wider scope of procrastination behaviours than previous behavioural measures. However, there are several limitations in the previous literature that ought to be addressed. Firstly, is the assumption that all delay as calculated by the measures in Moon and Illingworth (2005), DeWitte and Schouwenburg (2002), and Krause and Freund (2014) is due to procrastination. There are many reasons one might be

forced, involuntarily, to delay an intended action; however, this was not addressed in the examined literature. Secondly, previous studies using pseudo-behavioural measures have required that participants recall their behaviours anywhere from 24 hours prior (in Krause & Freund, 2014) to as far back as a week prior (in DeWitte & Schouwenburg, 2002) at the time of reporting. It is well established that memory biases can affect the reporting of behaviour (Schacter, 1999), and thus, a more immediate method of reporting procrastination may provide valuable information to the extant literature. Thirdly, the behavioural and pseudo-behavioural measures in previous studies have not been compared with both state and trait procrastination simultaneously to see how these relate. Finally, as pointed out by Krause and Freund (2014), previous studies have not controlled for the structure/type of measures used to assess associated constructs when making comparisons.

Current Research

As previously shown, procrastination is a prevalent and significant problem in modern day student populations with notable consequences for its practitioners. Procrastination has been related to increased stress and poor sleep quality, however, the direction of the relationship between these variables remains unclear due to the cross-sectional nature of most research. In addition, most research in the area has relied on self-report measures only. The studies that have used alternative measures of procrastination have been limited and have not measured procrastination as a voluntary irrational delay of intended actions (as defined in Steel, 2007). The current study aims to address these limitations in several ways. Firstly, procrastination was measured using both self-report questionnaires (trait/state) and a pseudo-behavioural measure. Over a two-week period, procrastination behaviour was assessed daily with a smart phone application using a randomly sampled instant-self-report method. Similarly, perceived stress and indicators of sleep quality in the current study were measured

using questionnaires as well as assessed daily (by said smartphone application) over a two-week period. Secondly, procrastination, sleep quality and stress were assessed multiple times in order to shed more light on the causal direction of the relationships between these variables.

The goals of the current study are threefold. Firstly, to determine whether self-report questionnaire measures (trait/state) and pseudo-behavioural measures of procrastination are measuring the same constructs. Secondly, to determine whether self-report questionnaire measures of procrastination or pseudo-behavioural measures of procrastination are more strongly associated with sleep and stress (using both questionnaire based measures of sleep and stress as well as pseudo-behavioural measures to avoid measurement bias). Thirdly, to expand on previous works by looking into the relationships between stress, procrastination and sleep with a longitudinal design to see how these three factors relate to each other. Following the results of Sirois and colleagues (2015), it is hypothesized that trait procrastination will predict overall sleep quality and that this relationship will be mediated by perceived stress. However, given that previous research has relied on cross sectional designs and few studies have looked at state procrastination, all plausible procrastination–stress–sleep mediation models will be examined.

Method

Participants

Sixty-seven volunteers completed baseline questionnaires for this study. Thirteen participants did not complete the follow-up questionnaires and/or completed less than one third of the daily information required by the Sleep and Procrastination Application (SPA; see Data analysis for details) and were therefore excluded from data analysis. The final sample therefore consisted of 54 participants (33 female, 21 male) with the majority of participants being under 20 and the second largest age group being the 20-24 year-old range. The oldest participant was 61 and the youngest was 18, with an average sample age of 24.24 years ($SD= 9.16$). Twenty-eight of these were undergraduate psychology students who were compensated with class credit for their time. The rest of the participants were students recruited through flyers, advertised around the University of Canterbury and on Facebook (see Appendix A). These participants received a \$10 Westfield voucher for their time. To be eligible for the study, participants had to own a working android smart phone. The advertisements were specifically aimed at those who frequently procrastinated and likely considered it a problem.

Measures

Questionnaires.

Participants completed questionnaires twice (baseline and follow-up), two weeks apart. Unless stated otherwise, the measures below were assessed at baseline and follow-up.

Trait procrastination (assessed at baseline only). The Pure Procrastination Scale (PPS; Steel, 2010) was used to assess trait procrastination. The PPS is a 12-item scale consisting of the core items of three widely used procrastination measures (the Decisional Procrastination Questionnaire, DPQ, Mann, Burnett, Radford & Ford, 1997; the Adult

Inventory of Procrastination, AIP, McCown & Johnson, 1989; the General Procrastination Scale, GPS, Lay, 1986). Steel (2010) subjected the DPQ, the AIP and the GPS to factor analyses (exploratory and confirmatory) and selected the 12 top-loading items to form the PPS. The PPS has shown high internal consistency and good convergent validity across global samples (Steel, 2010). The PPS has also been translated into other languages, again showing good internal consistency, test-retest reliability and cross-cultural usability (e.g., Rebetez, Rochat, Gay & van der Linden, 2014; Rozental, Forsell, Svensson, Forsström, Andersson, & Carlbring, 2014). Additionally, Cronbach's alpha in the current study was .88. The items of the PPS are measured on a 5-point scale ranging from 1 (*very seldom true or not true of me*) to 5 (*true of me*). Sample items used in the scale are "I delay making decisions until it's too late" and "I am not very good at meeting deadlines" (see Appendix B).

State procrastination. The Academic Procrastination State Inventory (APSI; Schouwenburg, 1995) was used to measure state procrastination. The APSI is a 23 item questionnaire. Participants were asked to record how well each statement applied to their behavior during the past week on a 5-point scale ranging from 1 (*not at all*) to 5 (*all of the time*). Some example items used in the scale were "Had doubts about your own ability" and "Forgot to prepare things for studying" (see Appendix B). The APSI has been shown to be both a reliable and valid measure of fluctuations in state procrastination (Schouwenburg 1995). Cronbach's alpha in the current study was .88 at Time 1 and .91 at Time 2.

Overall sleep quality. The Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, and Kupfer, 1989) was used to measure overall sleep quality. The PSQI is a self-report questionnaire that assesses seven domains of sleep (as they pertain to a participant's experiences in the prior month): sleep duration, sleep disturbances, sleep latency, daytime dysfunction, habitual sleep efficiency, subjective sleep quality and use of

sleep medication (see Appendix B). The global PSQI score is the sum of these domains and has a range of 0 to 21; with a higher PSQI score indicating poorer overall sleep quality.

While the PSQI has 18-items total, six of these are intended for clinical information only and are not calculated in the overall score. These superfluous items (which are typically completed by a bedmate or partner) were not administered in the current study. The PSQI has been shown to be a reliable and valid measure in a variety of clinical and non-clinical samples (Broomfield, & Espie, 2005).

The PSQI was altered at Time 2 to assess participants' experiences as they pertained to the week prior to the second administration of this questionnaire. It should be noted that, while this was only a minor alteration, this altered version of the PSQI has not been formally validated in the literature. The PSQI's Cronbach's alpha in the current study was .76 at Time 1 and .70 at Time 2.

Perceived stress. The Perceived Stress Scale (PSS; Cohen, Kamarck, and Mermelstein, 1983) was used to measure stress. The PSS is a 10-item self-report questionnaire that asks participants to rate how often they have experienced specific thoughts and feelings relating to stress over the past month from 0 (*never*) to 4 (*very often*). Example items include "In the past month, how often have you felt nervous or stressed?" and "In the past month, how often have you felt that difficulties were piling up so high that you could not overcome them?" (see Appendix B). The PSS is widely used and has exhibited good reliability and validity across a variety of samples (see Roberti, Harrington, & Storch, 2006; and Taylor, 2015 for a review).

The PSS was altered at Time 2 to assess participants' experiences as they pertained to the week prior to the second administration of this questionnaire. Once again, it should be noted that this altered "previous week" version of the PSS has not been formally validated in

the literature. The PSS's Cronbach's alpha in the current study was .82 at Time 1 and .84 at Time 2.

Pseudo-Behavioural Measures

While the measures described above are well validated and frequently used they, like all other questionnaires, rely on participants' memories. An alternative to using questionnaires is to use daily diary measures, but these too, rely on participants remembering to fill them out and require participants to recall their thoughts and feelings from earlier in the day. The current study attempted to modernize the idea of diary measures by creating the Sleep and Procrastination Application (SPA; see Appendix C). The SPA is an android smartphone application that was developed for the current study to measure an array of self-reported behaviours in real time (designed by Nikita Dow, author of this thesis, and programmed by Mitchell Winder, BSc). Over the course of two weeks the SPA measured: the quantity, inconsistency, and self-reported quality of sleep; the frequency and severity of procrastination; as well as self-reported daily stress levels. Including the day that participants downloaded the app and filled out the self-report questionnaires (recorded as Day 0) there were 15 days total where the app was used; or more accurately, 14 days comprised of 13 complete-days and two half-days (as participants were not able to provide "wake time" data on the first day nor "sleep time" data on the last day).

Average sleep quantity and inconsistency. The SPA measured the quantity and inconsistency of sleep by recording the daily sleep and wake times of each participant over two weeks (described above). This was then used to calculate the average number of hours slept each day (*Average sleep quantity*) and the standard deviation of hours slept for each participant (*Sleep inconsistency*).

The SPA recorded the time and date using the smartphone's internal clock whenever participants pressed the "Sleep" and "Awake" buttons on the home screen of the application. There was also a "Mistake" button available which provided participants with the opportunity to record any errors they made or provide additional data for previously missed days. Participants were asked to consider any short duration sleep disturbances (awake for 10 minutes or less) in their sleep quality ratings and not to record these as awakenings.

Average daily sleep quality. The measure of average daily sleep quality was obtained by asking participants to rate the quality of the previous night's sleep each time they pressed the "Awake" button. This sleep quality measure used a 7-point scale from 1 (*extremely bad*) to 7 (*extremely good*).

Procrastination rate and average procrastination severity. From Day 1 until Day 13 (inclusive) between the hours of 10am and 9pm (these hours were chosen to ensure that participants would typically be awake) participants would receive a text from the researcher at a randomized time, prompting them to press the "Procrastination Check" button. After pressing this button, participants were asked to briefly describe what they did during the hour directly prior (regardless of whether or not there was a significant delay in pressing the button after receiving the prompt). Following this question, participants were asked to rate the importance and then the urgency of their previous hour's activities. These ratings were done on a 7-point scale, from 1 (*unimportant* and *not urgent*, respectively) to 7 (*extremely important* and *extremely urgent*, respectively). Participants were also asked if they felt there was anything more important that they should have been doing in the previous hour. If they answered "yes", they were considered to be procrastinating and were instructed to briefly describe what this more important activity was.

It should be noted that there were several cases where participants answered "yes" but went on report that the "important activity" was not actually more important or that it would

have been unreasonable for them to have worked on the more important activity (e.g. the participant reported that the more important activity was “studying” but reported being “at work” in the previous hour). In these occurrences, participants were not considered to be procrastinating.

A participant’s procrastination rate was determined by the percentage of completed *daily random procrastination checks* in which a participant reported that they had been procrastinating in the hour prior to the check. Their procrastination severity rating was only calculated on days where they were determined to be procrastinating and was calculated based on how “unimportant” and “non-urgent” their behaviours were, during the previous hour. A maximally important and urgent task would naturally have a combined importance/urgency rating of 14 (see above), so the procrastination severity rating was the inverse of this ($\text{Severity} = 14 - \text{Urgency} - \text{Importance}$). For example, if a participant indicated that they were procrastinating during the hour prior to the procrastination check (see above) and rated the previous hour’s activities as 4 (*somewhat important*) and 1 (*not urgent*), then they would receive a procrastination severity score of 9 for that day. This gives each daily procrastination severity score a range of 0 to 12. These daily procrastination severity scores were then averaged over the course of two weeks to provide the average procrastination severity score for each participant (except for participants with less than 3 procrastination severity scores).

Average daily stress. The SPA measured stress levels using instant-self-report at the end of the daily random procrastination checks (described above). Participants were asked to rate their current feelings of stress on a 7-point scale, from 1 (*not stressed*) to 7 (*extremely stressed*). These daily ratings were averaged over the course of two weeks to provide the average daily stress score for each participant.

Procedure

The study was reviewed and approved by the University of Canterbury human Ethics Committee (see Appendix D) who required that all potential participants be emailed an information sheet (see Appendix E) before participating. After meeting with the head researcher (Nikita Dow) and giving consent to partake in the study, participants completed the baseline questionnaires (Time 1). These were completed online in Qualtrics and measured overall sleep quality (measured by the PSQI), and perceived stress levels (PSS) over the prior month, as well as state procrastination (APSI) and trait procrastination (PPS).

Participants then downloaded the SPA which was used for measuring sleeping habits, procrastination habits and stress on a daily basis over two weeks (see measures section for more details). I explained how to use the SPA in person with each participant and provided them with an additional two-page take home guide that reiterated these instructions (see Appendix E).

Over the next two weeks participants were instructed to indicate when they were attempting to sleep (not just going to bed) and when they woke up, using the SPA (see Appendix C). Each morning after pressing the “Awake” button, participants were also asked to rate the previous night’s sleep quality (described above).

In addition to this, the participants were messaged (via text) at a randomized time of day between 10am and 9pm and asked to complete a random procrastination check. Upon pressing the “Procrastination Check” button, they answered a short list of questions regarding their activities within the previous hour and their current feelings of stress (for more details see the measures section above).

After the two weeks of recording their sleeping habits, procrastination habits, and stress via the SPA, participants were prompted (by an email, an SPA message and a text) to complete the follow-up questionnaires (Time 2; described above). The raw data from the SPA

and electronic questionnaires were then compiled and the relevant information was extracted and organized before data analysis began.

Data Analysis

Treatment of missing data and preliminary analyses. Those who did not complete the follow-up questionnaires (Time 2) were excluded from data analysis ($N = 5$). Likewise, the participants who had completed these but had inadequate rates of responding on two or more pseudo-behavioural measures were excluded from data analysis ($N = 8$). Inadequate responding was defined as responding on less than one-third of days across the two week study period on any measure. The final sample consisted of 54 participants.

Despite having adequate rates of responding on all other SPA measures, four participants had inadequate rates of responding on the SPA's measure of sleep quality. Due to this, analyses using the average daily sleep quality measure had a lower N than other analyses. Likewise, analyses using the average procrastination severity measure had a lower N due to its method of calculation (procrastination severity was only calculated on days where a participant reported that they were procrastinating during the SPA's daily procrastination check).

Of the 13 procrastination checks, participants included in the data analysis completed an average of 11.05 checks. Likewise, these participants reported their sleep and awake times on an average of 12.38 days out of the required 14 days (see the measures section for more information). Of the 50 participants that provided adequate sleep quality data, sleep quality was reported on an average of 9.09 days out of 14.

Occasional instances of missing data on the self-report questionnaires were dealt with by averaging over the remaining items of the scale for that participant. Additionally,

Cronbach's alpha was computed for each multi-item scale to assess reliability of the measures used (see the Measures section for these results).

Descriptives. All questionnaires and app measures were averaged across participants to give a mean and standard deviation for each measure. These were then checked against the means and standard deviations found in previous research for reference. All measures were checked for appropriate skewness and kurtosis, and Cronbach's alpha was assessed for all multi-item measures. Additionally, the Time 1 and Time 2 self-report measures were tested for change using paired samples *t* tests.

Main analyses. Firstly, the variables within each construct (procrastination, sleep, and stress) were correlated to examine to what degree the different measurement methods were congruent. Secondly, the different measures of procrastination (trait self-report, state self-report, and the pseudo-behavioural measures) were each correlated with the various measures of sleep and stress to determine which measurement method had the most cross-concept associations. Finally, all cross-concept variables were correlated and examined for possible mediation analysis. To meet criteria for analysis, a proposed mediation model had to be correlated, have one variable from each construct, and have a logically possible causal path (e.g. trait procrastination could not be a criterion variable). As per my hypothesis, all eligible stress mediator models of the trait procrastination–sleep relationship were run through a multiple regression analysis. Following this, all eligible alternative mediation models were explored using the same method.

In each mediation analysis, the predictor variable was regressed on the criterion variable (*c* path). This regression was then repeated with the inclusion of the mediator variable (*c'* path and *b* path). Following this, the predictor variable was regressed on the mediator (*a* path). Figure 1 below provides a visual representation of this process. If the *a* path, *b* path and *c* path were significant and the *c'* path was not, then the model was

considered to reflect a possible full mediation effect. If all paths were significant, then the model was considered to reflect a possible partial mediation effect. The significance of the model was then assessed using a bootstrapping estimation approach with 5,000 samples as outlined in Preacher and Hayes (2004), where a model is considered significant if the 95% confidence interval does not contain zero. When a mediation was revealed to be significant, the approximate degree of variance accounted for by the model (R^2) was reported in text.

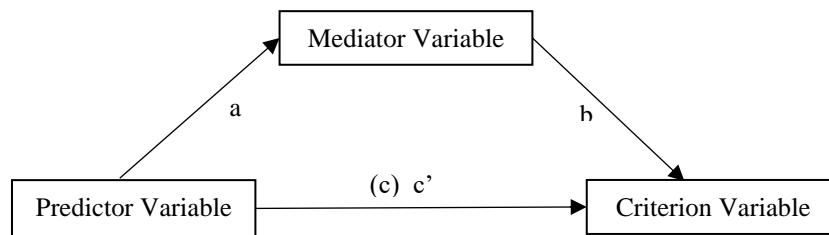


Figure 1. Example mediation model for the relationship between the predictor variable and criterion variable as mediated by the mediator variable.

Results

Descriptive Statistics

Table 1 presents the means and standard deviations for all measures in the study. The average trait procrastination (as measured by the PPS, completed at baseline only) of this sample was comparable to the results found by Steel (2010; $M = 3.42$, $SD = 0.85$ in a summed scale these are equivalent to $M = 41.04$, $SD = 10.20$) but had a notably lower standard deviation (see Table 1). The average state procrastination at Time 1 was higher than at Time 2; however, the standard deviation was higher for state procrastination at Time 2 indicating that state procrastination reports were more variable at Time 2 (see Table 1). On average, participants were found to be procrastinating during 36% of random procrastination checks.

The average perceived stress (as measured by the PSS) was lower than those reported in Cohen, and colleagues (1983; $M = 23.18$, $SD = 7.55$). Similar results were found by the SPA for which the average daily stress rating across participants averaged to be 3.17, reflecting that on average participants were ‘Only slightly stressed’.

The average overall sleep quality score (as measured by the PSQI) was above 5, indicating poor overall sleep quality (Buysse, et al., 1989). Conversely, the self-reported average daily sleep quality as measured by the SPA averaged out to be 4.5 across participants, reflecting an average daily sleep quality between ‘Not bad/okay’ and ‘Good’. The average hours slept across the 54 eligible participants on all recorded days was approximately 8 hours and 11 minutes with a standard deviation of approximately 1 hour and 47 minutes across all sleep recordings. Likewise, the average sleep inconsistency rating indicated that, on average, participants varied their daily hours slept by 1 hour and 28 minutes across the two week recording period with the standard deviation of this metric being approximately 49 minutes (converted to hours and minutes from the data in Table 1).

The means of all self-report Time 1 and Time 2 measures were examined for significant change. Within paired samples *t* tests suggested that, while overall sleep quality (measured by the PSQI) and perceived stress (PSS) at Time 1 were not significantly different from their respective scores at Time 2, this was not true of state procrastination (APSI). The state procrastination scores at Time 2 ($M = 61.74$, $SD = 13.87$) were significantly lower than the scores at Time 1 scores, $M = 65.07$, $SD = 11.59$, $t(53) = 2.42$, $p = .019$.

Table 1

Descriptive Statistics

Measures	Mean	Standard Deviation
<i>Self-Report Measures</i>		
Trait Procrastination	32.09	7.71
State Procrastination Time 1	65.07	11.59
State Procrastination Time 2	61.74	13.87
Perceived Stress Time 1	17.72	5.21
Perceived Stress Time 2	17.54	6.20
Overall Sleep Quality Time 1	6.37	2.73
Overall Sleep Quality Time 2	6.06	2.65
<i>Pseudo-Behavioural Measures</i>		
Hours Slept	8.18	1.78
Sleep Inconsistency	1.46	0.82
Average Daily Sleep Quality	4.50	0.64
Average Daily Stress	3.17	1.17
Procrastination Rate	0.36	0.22
Average Procrastination Severity	7.90	1.45

Note. Means and standard deviations of trait procrastination (as measured by the Pure Procrastination Scale), state procrastination (as measured by Academic Procrastination Inventory), perceived stress (as measured by the Perceived Stress Scale), overall sleep quality (as measured by Pittsburgh Sleep Quality Index), and the pseudo-behavioural measures as measured by the Sleep and Procrastination App; measures administered before the two week Sleep and Procrastination Application recordings are shaded.

Associations Between Self-Report and Pseudo-Behavioural Measures

To determine if the different types of measures were measuring the same or similar constructs, the various procrastination measures were correlated with each other. This process was then repeated with the sleep measures and then finally the various measures of stress.

Procrastination.

The rate of procrastination over the two week recording period (as measured by the SPA) was found to be moderately correlated (Cohen, 1988, pp. 79-80) with both trait procrastination (PPS), and state procrastination (APSI) at Time 2 (see Table 2). However, the rate of procrastination was not significantly correlated with state procrastination at Time 1. Similarly, a moderate correlation was found between average procrastination severity (as measured by the SPA) and state procrastination at Time 2. However, neither state procrastination at Time 1 nor trait procrastination was found to be associated with average procrastination severity. Surprisingly, participants' procrastination rate, and average procrastination severity were not significantly correlated with each other. Table 2 further shows that the self-report measures of state and trait procrastination correlated strongly with each other.

Sleep.

The average hours slept over the two week recording period (as measured by the SPA) was not significantly correlated with the overall sleep quality in either administration of the PSQI. Likewise, sleep inconsistency (as measured by the SPA) was not significantly correlated with overall sleep quality at Time 1 or Time 2.

The SPA's measure of average daily sleep quality fared much better. Average daily sleep quality was significantly correlated with overall sleep quality (PSQI) at both Time 1 and Time 2 (see Table 2). It should be noted that these correlations are negative because higher scores on the PSQI reflect poorer sleep quality whereas higher average daily sleep

quality scores reflect better sleep quality (see Table 2). Contrary to expectation, the average hours slept, sleep inconsistency and average daily sleep quality were not significantly correlated with each other.

Stress.

The average daily stress (as measured by the SPA) was significantly correlated with perceived stress (as measured by the PSS) at both Time 1 and Time 2 (see Table 2).

Associations between Procrastination, Sleep and Stress

To determine which measures of procrastination has the most cross-concept associations, the various procrastination measures were correlated with the different measures of sleep and stress. The shaded areas of Table 2 show how the different measures of procrastination related to the different measures of sleep and stress. Overall, the self-reported state measures of procrastination were found to have the most cross-concept associations. Trait procrastination was only associated with other self-report measures while state procrastination at both time points was associated with both self-report and pseudo-behavioural measures. Unfortunately, pseudo-behavioural measures of procrastination had no significant associations with any sleep or stress measures.

Sleep.

Pure procrastination scale. Trait procrastination was positively correlated with overall sleep quality at Time 1 and Time 2 but not with the average hours slept, sleep inconsistency or average daily sleep quality. In other words, worse trait procrastination scores were associated with worse (higher) PSQI scores but not with any of the pseudo-behavioural sleep measures (see the shaded area in Table 2).

Academic procrastination state inventory. State procrastination at both time points was weakly correlated with overall sleep quality at Time 1, and moderately correlated with

average daily sleep quality, but not with overall sleep quality at Time 2, average hours slept or sleep inconsistency. Of these, the strongest association was found to be between average daily sleep quality and state procrastination at Time 1 (see shaded area in Table 2).

Pseudo-behavioural procrastination measures. Neither the procrastination rate nor the average procrastination severity were significantly correlated with the average hours slept, sleep inconsistency, average daily sleep quality or overall sleep quality (at either time point).

Stress.

Pure procrastination scale. Trait procrastination was positively correlated with perceived stress (PSS) at both Time 1 and Time 2 but not with average daily stress (see shaded area in Table 2). In other words, worse trait procrastination was associated with worse perceived stress when using self-report but not when using the pseudo-behavioural measures of stress (as measured by the SPA).

Academic procrastination state inventory. State procrastination at both time points was positively correlated with average daily stress, and perceived stress at both times points. Perceived stress at Time 1 was most strongly associated with state procrastination at Time 1 and perceived stress at Time 2 was most strongly associated with state procrastination at Time 2. Average daily stress had a slightly stronger correlation with perceived stress at Time 1 than at Time 2 (see shaded area in Table 2).

Pseudo-behavioural procrastination measures. Once again, neither the procrastination rate nor the average procrastination severity were significantly correlated with average daily stress or perceived stress at either administration. However, average procrastination severity and average daily stress showed a non-significant trend which suggested a negative correlation between these measures may have been found with a larger sample size (see shaded area in Table 2).

Table 2

Correlation Matrix of Procrastination, Sleep and Stress Measures

		Procrastination Measures					Sleep Measures					Stress Measures	
		1	2	3	4	5	6	7	8	9	10	11	12
Procrastination Measures													
1	Trait procrastination												
2	State procrastination Time 1	.668***											
3	State procrastination Time 2	.618***	.698***										
4	Procrastination Rate ^d	.305*	.252	.328*									
5	Average Procrastination Severity ^d	.317 ^b	.147 ^b	.340*^b	-.096 ^b								
Sleep Measures													
6	Overall sleep quality Time 1	.373**	.300*	.291*	.116	-.061 ^b							
7	Overall sleep quality Time 2	.273*	.194	.225	-.003	.081 ^b	.745***						
8	Average Hours Slept ^d	-.035	.073	.025	-.107	-.202 ^b	.044	.107					
9	Sleep Inconsistency ^d	-.012	-.031	-.087	.077	-.061 ^b	-.051	-.004	.219				
10	Average Daily Sleep Quality ^d	-.264 ^a	-.454***^a	-.319*^a	-.115 ^a	-.048 ^c	-.424***^a	-.484***^a	.029 ^a	.085 ^a			
Stress Measures													
11	PSS Time 1	.514***	.647***	.466***	.129	-.020 ^b	.311*	.248	.051	.143	-.303*^a		
12	PSS Time 2	.537***	.483***	.616***	.117	.161 ^b	.421**	.493***	.123	.120	-.322*^a	.637***	
13	Average Daily Stress ^d	.224	.307*	.268*	.010	-.301 ^b	.210	.171	.266	.327*	-.078 ^a	.371**	.421**

Note. Trait procrastination (as measured by the Pure Procrastination Scale), state procrastination (as measured by the Academic Procrastination Inventory), perceived stress at Time 1 and 2 (as measured by the Perceived Stress Scale), the overall sleep quality at Time 1 and 2 (as measured by the Pittsburgh Sleep Quality Index); cross-concept correlations are shaded; $N = 54$ unless specified.

^a $N = 50$, ^b $N = 37$, ^c $N = 33$, ^d Pseudo-behavioural measure (as measured by the Sleep and Procrastination App).

* $p < .05$, ** $p < .01$, *** $p < .001$.

Mediation Analyses

Regression analyses were used to examine the relationship between stress, procrastination, and sleep. I first examined whether stress mediated the relationship between trait procrastination and sleep (as per my hypothesis). Secondly, given that previous research has been inconclusive with respect to the direction of the relationships between these variables, I then examined all other possible mediation models. For each mediation model the correlations in Table 2 were examined to find support for the use of path analysis. Many models were theoretically possible, however, only models in which the predictor and criterion variables were assessed at different time points were examined. Purely cross-sectional models were not considered and all proposed variables had to significantly correlate with each other. The results for the eligible models are presented in Table 3.

Stress as a mediator of trait procrastination and sleep.

As per my hypothesis, Time 2 perceived stress was assessed as a potential mediator in the relationship between Time 1 trait procrastination (PPS) and Time 2 overall sleep quality (PSQI). The findings are presented in Figure 2 and Table 3. A Time 1 perceived stress mediator model was also considered but did not meet the criteria for path analysis (see Table 2). Following the method outlined in Preacher and Hayes, (2004), Trait procrastination was found to be a significant predictor of Time 2 perceived stress (a path). Likewise, Time 2 perceived stress was a significant predictor of Time 2 overall sleep quality (b path). Moreover, the standardized regression coefficient between trait procrastination and Time 2 overall sleep quality (c path) decreased substantially and became nonsignificant when controlling for Time 2 perceived stress (c' path), suggesting full mediation. Additionally, this model accounted for approximately 24% of the variance (R^2) in PSQI (overall sleep quality) Time 2 scores. The indirect effect of this model was assessed using a bootstrap estimation approach with 5000 samples (Preacher & Hayes, 2004). With this approach, a mediator is

considered significant when the 95% confidence interval of the bootstrapping results does not include zero. This was indeed the case, $b = 0.09$, $SE = .05$, $CI = 0.022, 0.203$.

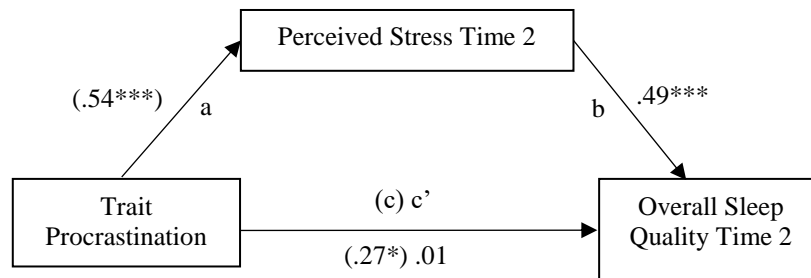


Figure 2. Standardized regression coefficients for the relationship between Trait procrastination (as measured by the Pure Procrastination Scale) and overall sleep quality (as measured by the Pittsburgh Sleep Quality Index) at Time 2 as mediated by perceived stress (as measured by the Perceived Stress Scale) at Time 2; $N = 54$; the direct standardized regression coefficients are in parentheses.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Alternative mediation models.

Stress as a mediator of sleep and state procrastination. The correlations in Table 2 show that perceived stress (PSS) at Time 1 or Time 2 could potentially mediate the relationship between overall sleep quality (PSQI) at Time 1 and state procrastination (APSI) at Time 2. The results of these analyses are presented in Table 3.

Time 1 overall sleep quality was a significant predictor of both Time 1 perceived stress (a path) and Time 2 state procrastination (c path). Likewise, perceived stress at Time 1 significantly predicted Time 2 state procrastination (b path) and when this variable was added to the model the standardized regression coefficient between Time 1 overall sleep quality and Time 2 state procrastination decreased substantially and became nonsignificant (c' path), suggesting full mediation. These combined predictors accounted for approximately 24% of the variance in Time 2 state procrastination scores. The indirect effect was assessed using a bootstrap estimation approach and was significant (see Table 3).

A similar analysis was conducted using Time 2 perceived stress as the mediator. After confirming the predictive ability of the a, b, and c paths, it was found that the standardized

regression coefficient between overall sleep quality at Time 1 and state procrastination at Time 2 once again decreased substantially and became non-significant (c' path) when controlling for perceived stress at Time 2, suggesting full mediation. The unstandardized indirect effect from the bootstrapping procedure (see Table 3) was once again significant. Additionally, this model accounted for a greater degree of variance (approximately 38%) in state procrastination Time 2 scores.

Only one variable reversal of the sleep–state procrastination relationship met criteria for path analysis. The analyses performed examined whether Time 1 perceived stress mediated the relationship between Time 1 state procrastination and average daily sleep quality. Although this model had a significant a path, it did not have a significant b path. Moreover, the unstandardized indirect effect from the bootstrapping procedure (see Table 3) was nonsignificant, suggesting a lack of mediation.

Sleep as a mediator of trait procrastination and stress. Six models with sleep as a mediator proved to be eligible for path analysis. Overall sleep quality at Time 1 and Time 2 were analyzed as mediators of the trait procrastination–Time 2 perceived stress relationship. Additionally, overall sleep quality at Time 1 and average daily sleep quality were analyzed as mediators of the Time 1 state procrastination–Time 2 perceived stress relationship as well as mediators for the logical reversals of these, namely, the Time 1 perceived stress–Time 2 state procrastination relationship.

Table 3 shows that the standardized regression coefficient between trait procrastination and perceived stress at Time 2 (c path) decreased substantially (but remained significant) when controlling for overall sleep quality at Time 1 (c' path), suggesting partial mediation. The unstandardized indirect effect from the bootstrapping procedure (see Table 3) was found to be significant. This model was able to account for approximately 34% of the variance in perceived stress scores at Time 2.

Table 3

Results of All Mediation Analyses

Time 1	Time 2	Standardised β Coefficients				Bootstrapping results			R^2
		Path a	Path b	Path c	Path c'	b	SE	95% CI	
Stress as a mediator									
<i>Perceived stress Time 1 as a mediator</i>									
State procrastination	Average daily sleep quality	.48***	-0.22	-.45***	-.44***	0.03	.02	-0.011, 0.071	.21
Overall sleep quality	State procrastination	.31*	.42**	.29*	.16	0.66	.33	0.148, 1.506	.24
<i>Perceived stress Time 2 as a mediator</i>									
Trait procrastination	Overall sleep quality ^a	.54***	.49***	.27*	.01	0.09	.05	0.022, 0.203	.24
Overall sleep quality	State procrastination	.42**	.60***	.29*	.04	1.28	.48	0.471, 2.420	.38
Sleep as a mediator									
<i>Overall sleep quality Time 1 as a mediator</i>									
Trait procrastination	Perceived stress	.37**	.26*	.54***	.44**	0.08	.05	0.004, 0.212	.34
State procrastination	Perceived stress	.30*	.30*	.48***	.39***	0.05	.04	0.003, 0.151	.32
Perceived stress	State procrastination	.31*	.16	.47***	.42**	0.13	.13	-0.042, -0.481	.24
<i>Overall sleep quality Time 2 as a mediator</i>									
Trait procrastination	Perceived stress	.27*	.37**	.54***	.43***	0.08	.05	0.011, 0.223	.42
<i>Average daily sleep quality Time 2 as a mediator</i>									
State procrastination	Perceived stress	-.45	-.13	.48***	.42**	0.04	.04	-0.034, 0.137	.24
Perceived stress	State procrastination	-.30*	-.18	.51***	.45**	0.15	.14	-0.033, 0.541	.29
Procrastination as a mediator									
<i>State procrastination Time 1 as a mediator</i>									
Overall sleep quality	Perceived stress	.30*	.39**	.42**	.30*	0.26	.12	0.068, 0.548	.32
<i>State procrastination Time 2 as a mediator</i>									
Overall sleep quality	Perceived stress	.29*	.41*	.31*	.19	0.36	.17	0.063, 0.760	.25

Note. Trait procrastination (as measured by the Pure Procrastination Scale), state procrastination (as measured by the Academic Procrastination Inventory), perceived stress at Time 1 and 2 (as measured by the Perceived Stress Scale), the overall sleep quality at Time 1 and 2 (as measured by the Pittsburgh Sleep Quality Index); the shaded values signify that there was a significant change in the R^2 value when the mediator was added to the regression model; $N = 54$ unless the model contains average daily sleep quality (as measured by the Sleep and Procrastination Application) in which case, $N = 50$.

^a Hypothesized mediation model.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Similarly, the standardized regression coefficient between trait procrastination and perceived stress at Time 2 also decreased substantially (but remained significant) when controlling for Time 2 overall sleep quality. Additionally, the unstandardized indirect effect from the bootstrapping procedure (see Table 3) was also found to be significant. Moreover, this model was able to account for approximately 42% of the variance in perceived stress scores at Time 2.

Sleep as a mediator of state procrastination and stress. Overall sleep quality at Time 1 also seemingly mediated the effects of state procrastination at Time 1 on perceived stress at Time 2. The analyses suggested partial mediation (the c' path reduced but remained significant) and the unstandardized indirect effect from the bootstrapping procedure (see Table 3) was found to be significant and this model was able to account for approximately 32% of the variance in Time 2 perceived stress scores.

Despite this, an equivalent mediation model using average daily sleep quality as the mediator was not found to be significant. Average daily sleep quality was not able to significantly predict perceived stress at Time 2 while accounting for Time 1 state procrastination (b path). Moreover, the R^2 value between state procrastination at Time 1 and perceived stress at Time 2 did not significantly increase when average daily sleep quality was added, indicating that this variable did not significantly improved the prediction. Additionally, the unstandardized indirect effect from the bootstrapping procedure (see Table 3) was nonsignificant.

Sleep as a mediator of stress and state procrastination. Path analyses were conducted on overall sleep quality at Time 1 and average daily sleep quality as mediators of the Time 1 perceived stress–Time 2 state procrastination relationship. Both models presented with non-significant b paths and nonsignificant R^2 change values. Thus, both the overall sleep quality at Time 1 mediator model and the average daily sleep quality mediator model

presented with non-significant indirect effects when the bootstrapping procedure was applied (see Table 3).

State procrastination as a mediator of sleep and stress. When state procrastination at Time 1 and 2 were assessed as mediators in the sleep–stress relationship, results suggested that state procrastination at Time 1 may partially mediate the relationship between overall sleep quality at Time 1 and perceived stress at Time 2 (see Table 3). Conversely, state procrastination at Time 2 was shown to fully mediate this relationship (see Figure 13). The unstandardized indirect effects from the bootstrapping procedures proved to be significant for both the state procrastination Time 1 mediator model and the Time 2 mediator model (see Table 3). These models were able to account for approximately 32% and 25% of the variance in perceived stress Time 2 scores, respectively. No combination of variables that reflected the concept of procrastination mediating the relationship of the effects of stress on sleep met criteria for path analysis.

Discussion

The aims of the current research were threefold. The first of these was to determine whether self-report questionnaire measures (trait/state) and pseudo-behavioural measures of procrastination were measuring the same constructs. Secondly, to determine which procrastination measurement method has the greatest degree of associations with various measures of stress and sleep. Finally, this study aimed to explore the relationships between sleep, stress and procrastination.

Associations Between Self-Report and Pseudo-Behavioural Measures

Regarding the first aim of this study, results showed associations across different measurement methods for all three constructs with cross-method measures of stress being the most reliable and cross-method measures of sleep having the fewest number of intra-associations. Evidence from previous works has suggested that self-reported trait measures of procrastination and behavioural measures of procrastination measure different constructs (DeWitte & Schouwenburg, 2002; Solomon & Rothblum, 1984). The current results suggested that the procrastination rate is measuring a construct most similar to that which is measured by the self-report state procrastination measure. The procrastination rate was found to be moderately correlated with Time 2 state procrastination. This result is not surprising given that the period of time referenced by state procrastination at Time 2 overlaps with the second week of participant's SPA recordings. Indeed, one would expect that if the SPA's procrastination rate was only assessed over the same time period as the state procrastination measure (one week), then perhaps these measures would have revealed an even stronger association.

Notably, no significant correlation was found between state procrastination at Time 1 and the procrastination rate. This result at first glance seems to indicate that participant's self-

reported procrastination habits in the week directly prior to the recording period was not predictive of their procrastination habits during the recording period.

However, the self-reported state measure of procrastination at Time 2 was itself strongly correlated with the same measure at Time 1 which conflicts with this conclusion. Nonetheless, despite being correlated, a paired sample t test indicated that the Time 1 and 2 measures of state procrastination were significantly different. The correlation between Time 1 and 2 may simply reflect common method variance. Indeed, given that both the Time 1 overall sleep quality and perceived stress measures also had stronger associations with their Time 2 counter parts than with their relevant pseudo-behavioural measures, this is a reasonable conclusion. Alternatively, it is possible that the use of the SPA during the two week recording period affected participants' later reports of state procrastination (Time 2) or perhaps even directly affected their procrastination habits. It could be that, by being made more aware of their daily habits and by being reminded of the important tasks that they were putting off, participants were more motivated and better able to guard against their procrastination tendencies. Conversely, as Steel (2001) suggested, it could be that self-reported measures of state procrastination (like trait procrastination) are tainted by self-concept and that participants who had a tendency to retrospectively negatively evaluate their behaviors had their biases mitigated by the act of recording their daily behaviours over two weeks.

Interestingly, despite having a notably lower N , average procrastination severity was more closely associated with self-reported state procrastination at Time 2 than the procrastination rate measure was. This is surprising as the state procrastination measure and the SPA's procrastination rate both measure the frequency of procrastination behaviours, while the SPA's procrastination severity measure does not. The average procrastination severity measure taps into a relatively novel aspect of procrastination, by asking participants

to rate the perceived urgency and importance of their procrastination behaviours, it evaluates the *productiveness* of procrastination behaviours. Critically, not all procrastination is equal. The individual who procrastinates on a thesis by cleaning their room or working on an alternative project is still better off than the individual who procrastinated on their thesis by scrolling through Facebook or watching Youtube videos. It is interesting that trait procrastination was found to be moderately correlated with the procrastination rate measure and strongly correlated with both self-reported state procrastination measures but not with procrastination severity. While it seems intuitive that trait procrastinators would not only procrastinate more but would procrastinate more severely, the trait procrastination measure appears to better encapsulate a tendency for greater procrastination frequency rather than procrastination severity. Given the association between Time 2 state procrastination and procrastination severity it may be that instances of more severe (more wasteful) procrastination behaviours are more memorable in the short term and thus are more likely to be reflected in later self-reported state measures.

Associations between Procrastination, Sleep and Stress

Regarding the second aim of this study, previous research has found that behavioural and pseudo-behavioural measures of procrastination were better predictors of academic outcomes than self-reported trait measures (Moon & Illingworth, 2005; Steel, 2001) but that self-reported measures were more closely associated with mood and affective well-being (Krause & Freund, 2014; Steel, 2001). When the different measures of procrastination were compared, self-reported trait procrastination was found to be strongly correlated with self-reported perceived stress and overall sleep quality at both time points but not with any of the pseudo-behavioural measures. This suggests that trait measures of procrastination are not sensitive to the day to day fluctuations of sleep quality, quantity, and stress.

Self-reported state procrastination at each time point was strongly associated with perceived stress at the equivalent time point and moderately associated with perceived stress at the opposing time point. Overall sleep quality at Time 1 was moderately correlated with Time 1 state procrastination and weakly correlated with Time 2. Additionally, the SPA's measures of average daily stress and average daily sleep quality showed significant associations with both administrations of the state procrastination measure. It appears that state procrastination measure had the greatest number of associations across the various measures of sleep and stress. Conversely, neither the SPA's measure of procrastination rate nor severity were significantly correlated with any of the sleep or stress measures. These results appear to reflect that the day to day instances of procrastination are not indicative of day to day instances of sleep quality/quantity or perceptions of stress. However, it appears that the larger patterns of procrastination behaviours (such as those measure by the state procrastination measure) are themselves related to day to day perceptions of stress and sleep quality. In other words, a single instance of procrastination doesn't appear to affect or be affected by that day's perceived stress or sleep quality but overtime daily stress and sleep quality are associated with self-reported patterns of procrastination behaviours.

Much like the conclusions made by Krause and Freund (2014), these results appear to support the use of self-reported state procrastination measures and imply that self-reported state measures may be less sensitive to variations in the method of measurement than the pseudo-behavioural measures employed in this study. However, the lack of associations between the various pseudo-behavioural measures could instead be due to the low sample size and short measurement period in this study.

Mediation Models

The third goal of this study was to investigate possible mediation effects in the procrastination–stress–sleep relationship. Following the results of Sirois and colleagues (2015), it was hypothesized that trait procrastination would predict later overall sleep quality and that this relationship would be mediated by perceived stress.

Indeed, it was found that trait procrastination was able to predict later overall sleep quality and that this direct effect was greatly reduced (to the point of non-significance, suggesting full mediation) by adding perceived stress at Time 2 to the model. This appears to indicate that trait procrastinators are more likely to have poorer overall sleep quality, and that this is mostly due to their increased experiences of perceived stress. It could be that trait procrastinators, not only have a tendency to use avoidance-based maladaptive coping mechanisms (Sirois & Kitner, 2015; Sirois & Pychyl, 2013), but also have a greater sensitivity to daily stressors which exacerbates this behaviour. This increase in perceived stress may then worsen overall sleep quality (Lund, Reider, Whiting, & Prichard, 2010; Morin, Rodrigue, & Ivers, 2003; Sadeh, Keinan, & Daon, 2004), through behaviours such as rumination (Thomsen, Mehlsen, Christensen, & Zachariae, 2003).

However, trait procrastination was also able to predict later perceived stress, with overall sleep quality (Time 1 and Time 2) partially mediating this relationship. Of the mediation models examined in this study, the model that accounted for the greatest degree of variance in its criterion variable, was the model that presented overall sleep quality at Time 2 as a mediator of trait procrastination and perceived stress at Time 2. It appears that, while perceptions of stress are able to account for a large proportion of the effect of trait procrastination on overall sleep quality, some of the effect that trait procrastination has on perceived stress is explained by overall sleep quality. It may be that high trait procrastinators have a tendency to procrastinate going to bed (Kroese, De Ridder, Evers, & Adriaanse, 2014)

or difficulties regulating their sleeping habits that affects their sleep quality and worsens perceptions of stress.

The role of state procrastination.

Time 1 overall sleep quality was able to predict later state procrastination, with stress at Time 1 fully mediating this relationship. Similar results were found for stress at Time 2, however, the perceived stress at Time 2 mediator model was able to account for a greater degree of variance in Time 2 state procrastination scores, potentially indicating that contemporary perceived stress has a greater impact on reports of state procrastination than previous stress. Moreover, the logical variable-reversals of these models (with early state procrastination predicting later overall sleep quality) did not meet the criteria for path analysis. The only possible logical reversal of this model that met criteria for path analysis (see Table 3) proved to be non-significant. It appears that early poorer overall sleep quality predicts increased later state procrastination and that this effect is explained mostly by an increase in perceived stress. This could reflect a depletion in mental resources due to insufficient or inadequate sleep resulting in a later increased sense of stress (Dinges et al., 1997) and thus, an increase in avoidant behaviours (procrastination) in the short term (Sirois & Pychyl, 2013).

Overall sleep quality at Time 1 was also found to partially mediate the relationship between early state procrastination and later perceived stress. In other words it appears that those who procrastinated more prior to the two week recording period were more likely to have increased perceptions of stress at the end of the study, and some of this effect was due to their overall sleep quality.

Time 1 state procrastination was also found to partially mediate the relationship between overall sleep quality at Time 1 and perceived stress at Time 2. However, state procrastination at Time 2 fully mediated this sleep-stress relationship. In other words, it

appears that contemporary state procrastination is able to explain a large portion of the relationship between early overall sleep quality and later perceived stress but earlier instances of state procrastination have a lesser effect.

A proposed model of the procrastination–sleep–stress relationship.

One interpretation of these results is that trait procrastinators have a greater tendency to perceive deadlines, demanding tasks and even daily life as stressful. This increased perception of stress results in poorer overall sleep quality (perhaps due to procrastination-related rumination as in Digdon & Howell, 2008; Stainton et al., 2000). Additionally, high trait procrastinators may also independently have a general tendency towards patterns of behaviour that result in poorer overall sleep quality (perhaps due to poor self-regulation and/or poor sleep hygiene; Kroese et al., 2014) which itself exacerbates perceptions of stress. These procrastinators may then procrastinate on certain tasks, as previous research has suggested (Sirois & Pychyl, 2013), as an inadequate method of coping with their perceived stress. This procrastination then worsens their feelings of stress as the deadlines moves closer and the amount of work required to catch up becomes more substantial. State procrastination and perceived stress may then perpetuate each other in a cyclical fashion until the deadline is reached and perceived stress reduces.

Limitations and Future Research

While this study aimed to improve on the cross-sectional nature of previous works, it was however, limited by its short recording period and low sample size. This especially affected the SPA measures. In particular, the procrastination rate and severity measures may have under-reported the true procrastination habits of participants due to infrequent sampling and low completion rates. However, unlike many previous measures, the pseudo-behavioural measures used in the SPA were specifically designed to measure procrastination as it has

been defined by previous literature on procrastination (Steel, 2007). The current study's pseudo-behavioural measures also sampled participants more frequently, and were less academically focused than previous behavioural and pseudo-behavioural measures (such as those used in DeWitte & Schouwenburg 2002; and Krause & Freund, 2014). Nonetheless, longer study periods and more frequent sampling is recommended for future studies intending to use the SPA or similar application based measures of procrastination.

One aspect that was not controlled for in this study, was the workload and deadlines of participants. Different participants ran through the study at different times during the year and thus, some may have had more approaching deadlines than others. Moreover, different courses and degrees require different amounts of work and can have more/less frequent deadlines than other courses, affecting the amount of procrastination. Future studies should investigate how the number of upcoming deadlines and commitments each participant has effects their procrastination habits and perceptions of stress.

Additionally, this study did not investigate how pseudo-behavioural measures (such as the SPA) relate to practical outcomes such as job performance, student GPA's and exam scores in comparison to state and trait self-report measures. Future research should include practical outcome measures when comparing different measures of procrastination.

Finally, research into procrastination interventions could build on this study's findings by targeting sleep and perceived stress as maintenance variables. In particular, an intervention delivered through a smartphone app may prove to be an efficient and cost effective treatment option with a convenient way of monitoring how said intervention is affecting daily stress, sleep, and procrastination habits.

Concluding Remarks

Findings of the present study support the use of state procrastination measures and further highlight the issues of comparing trait self-report measures to state behavioural and outcome measures reported in Steel (2001). Consistent with Lindsley and colleagues' (1995) conclusions, the current results also provide support for the idea that procrastination and stress amplify and perpetuate one another, and suggest that the overall sleep quality may play a role in this relationship. Likewise, the current study supports the results reported in Sirois and colleagues (2015) that stress mediates the relationship between trait procrastination and overall sleep quality. Additionally, this study provides further insight into students' procrastination patterns, which may be applied to guide future research on procrastination interventions. Findings of the present study point to variables (e.g., overall sleep quality, stress) that may be involved in the initiation and/or maintenance of procrastination. These variables should be empirically investigated as targets of interventions that aim to reduce procrastination and ultimately mitigate its destructive and self-perpetuating consequences.

References

- Aitken, N. D. (1982). College student performance, satisfaction and retention: Specification and estimation of a structural model. *The Journal of Higher Education*, 53(1), 32-50.
- Blunt, A. K., & Pychyl, T. A. (2000). Task aversiveness and procrastination: A multi-dimensional approach to task aversiveness across stages of personal projects. *Personality and Individual Differences*, 28(1), 153-167.
- Buboltz Jr, W. C., Brown, F., & Soper, B. (2001). Sleep habits and patterns of college students: a preliminary study. *Journal of American college health*, 50(3), 131-135.
- Buyse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry research*, 28(2), 193-213.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.) United States: Lawerance Erlbaum Associates.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of health and social behavior*, 385-396.
- Colman, S. S., Brod, M., Potter, L. P., Buesching, D. P., & Rowland, C. R. (2004). Cross-sectional 7-year follow-up of anxiety in primary care patients. *Depression and anxiety*, 19(2), 105-111.
- Day, V., Mensink, D., & O'Sullivan, M. (2000). Patterns of academic procrastination. *Journal of College Reading and Learning*, 30(2), 120-134.
- Dewitte, S., & Schouwenburg, H. C. (2002). Procrastination, temptations, and incentives: The struggle between the present and the future in procrastinators and the punctual. *European Journal of Personality*, 16(6), 469-489.

- Digdon, N. L., & Howell, A. J. (2008). College students who have an eveningness preference report lower self-control and greater procrastination. *Chronobiology international*, 25(6), 1029-1046.
- Dinges, D. F., Pack, F., Williams, K., Gillen, K. A., Powell, J. W., Ott, G. E., ... & Pack, A. I. (1997). Cumulative sleepiness, mood disturbance, and psychomotor vigilance performance decrements during a week of sleep restricted to 4–5 hours per night. *Sleep*, 20(4), 267-277.
- Fee, R. L., & Tangney, J. P. (2000). Procrastination: A means of avoiding shame or guilt?. *Journal of Social Behavior and Personality*, 15(5), 167.
- Ferrari, J. R. (1991). Compulsive procrastination: Some self-reported characteristics. *Psychological reports*, 68(2), 455-458.
- Ferrari, J. R., Keane, S. M., Wolfe, R. N., & Beck, B. L. (1998). The antecedents and consequences of academic excuse-making: Examining individual differences in procrastination. *Research in Higher Education*, 39(2), 199-215.
- Ferrari, J. R., O'Callaghan, J., & Newbegin, I. (2005). Prevalence of Procrastination in the United States, United Kingdom, and Australia: Arousal and Avoidance Delays among Adults. *North American Journal of Psychology*, 7(1).
- Flett, G. L., Stainton, M., Hewitt, P. L., Sherry, S. B., & Lay, C. (2012). Procrastination automatic thoughts as a personality construct: An analysis of the procrastinatory cognitions inventory. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 30(4), 223-236.
- Hairston, I. S., & Shpitalni, R. (2016). Procrastination is linked with insomnia symptoms: The moderating role of morningness-eveningness. *Personality and Individual Differences*, 101, 50-56.

- Harriott, J., & Ferrari, J. R. (1996). Prevalence of procrastination among samples of adults. *Psychological Reports*, 78(2), 611-616.
- Haycock, L. A., McCarthy, P., & Skay, C. L. (1998). Procrastination in college students: The role of self-efficacy and anxiety. *Journal of counseling & development*, 76(3), 317-324.
- Kachgal, M. M., Hansen, L. S., & Nutter, K. J. (2001). Academic procrastination prevention/intervention: Strategies and recommendations. *Journal of Developmental Education*, 25(1), 14.
- Klassen, R. M., Krawchuk, L. L., & Rajani, S. (2008). Academic procrastination of undergraduates: Low self-efficacy to self-regulate predicts higher levels of procrastination. *Contemporary Educational Psychology*, 33(4), 915-931.
- Koskenvuo, M., Hublin, C., Partinen, M., Heikkilä, K., & Kaprio, J. (2007). Heritability of diurnal type: a nationwide study of 8753 adult twin pairs. *Journal of sleep research*, 16(2), 156-162.
- Krause, K., & Freund, A. M. (2014). Delay or procrastination—A comparison of self-report and behavioral measures of procrastination and their impact on affective well-being. *Personality and Individual Differences*, 63, 75-80.
- Kroeze, F. M., De Ridder, D. T., Evers, C., & Adriaanse, M. A. (2014). Bedtime procrastination: introducing a new area of procrastination. *Frontiers in psychology*, 5, 611.
- Kühnel, J., Bledow, R., & Feuerhahn, N. (2016). When do you procrastinate? Sleep quality and social sleep lag jointly predict self-regulatory failure at work. *Journal of Organizational Behavior*, 37(7), 983-1002.
- Lay, C. H. (1986). At last, my research article on procrastination. *Journal of research in personality*, 20(4), 474-495.
- Lay, C. H. (1986). At last, my research article on procrastination. *Journal of research in personality*, 20(4), 474-495.

- Lindsley, D. H., Brass, D. J., & Thomas, J. B. (1995). Efficacy-performing spirals: A multilevel perspective. *Academy of management review*, 20(3), 645-678.
- Lund, H. G., Reider, B. D., Whiting, A. B., & Prichard, J. R. (2010). Sleep patterns and predictors of disturbed sleep in a large population of college students. *Journal of adolescent health*, 46(2), 124-132.
- Mayers, A. N. (1946). Anxiety and the group. *Journal of Nervous and Mental Disease*.
- McCown, B., Blake, I. K., & Keiser, R. (2012). Content analyses of the beliefs of academic procrastinators. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 30(4), 213-222.
- McCown, W., Johnson, J., & Petzel, T. (1989). Procrastination, a principal components analysis. *Personality and Individual Differences*, 10(2), 197-202.
- Mehrabian, A. (2000). Beyond IQ: Broad-based measurement of individual success potential or "emotional intelligence". *Genetic, Social, and General Psychology Monographs*, 126(2), 133.
- Meier, A., Reinecke, L., & Meltzer, C. E. (2016). "Facebocrastination"? Predictors of using Facebook for procrastination and its effects on students' well-being. *Computers in Human Behavior*, 64, 65-76.
- Moon, S. M., & Illingworth, A. J. (2005). Exploring the dynamic nature of procrastination: A latent growth curve analysis of academic procrastination. *Personality and Individual Differences*, 38(2), 297-309.
- Morin, C. M., Rodrigue, S., & Ivers, H. (2003). Role of stress, arousal, and coping skills in primary insomnia. *Psychosomatic medicine*, 65(2), 259-267.
- Morris, C. D., Menashe, V. D., Anderson, P. H., Malinow, M. R., & Illingworth, D. R. (1990). Community cholesterol screening: medical follow-up in subjects identified with high plasma cholesterol levels. *Preventive medicine*, 19(5), 493-501.

- Nguyen, B., Steel, P., & Ferrari, J. R. (2013). Procrastination's Impact in the Workplace and the Workplace's Impact on Procrastination. *International Journal of Selection and Assessment*, 21(4), 388-399.
- Niermann, H., & Scheres, A. (2014). The relation between procrastination and symptoms of attention-deficit hyperactivity disorder (ADHD) in undergraduate students. *International journal of methods in psychiatric research*, 23(4), 411-421.
- Onwuegbuzie, A. J. (2000). I'll Begin My Statistics Assignment Tomorrow: The Relationship between Statistics Anxiety and Academic Procrastination.
- Patrzek, J., Sattler, S., van Veen, F., Grunschel, C., & Fries, S. (2015). Investigating the effect of academic procrastination on the frequency and variety of academic misconduct: a panel study. *Studies in Higher Education*, 40(6), 1014-1029.
- Pinyerd, T. (2013). The Effects of Social Media on College Students.
- Przepiorka, A., Błachnio, A., & Díaz-Morales, J. F. (2016). Problematic Facebook use and procrastination. *Computers in Human Behavior*, 65, 59-64.
- Pychyl, T. A., Lee, J. M., Thibodeau, R., & Blunt, A. (2000). Five days of emotion: An experience sampling study of undergraduate student procrastination. *Journal of social Behavior and personality*, 15(5), 239.
- Roig, M., & DeTommaso, L. (1995). Are college cheating and plagiarism related to academic procrastination?. *Psychological reports*, 77(2), 691-698.
- Rozental, A., & Carlbring, P. (2014). Understanding and treating procrastination: A review of a common self-regulatory failure. *Psychology*, 5(13), 1488.
- Saddler, C. D., & Sacks, L. A. (1993). Multidimensional perfectionism and academic procrastination: Relationships with depression in university students. *Psychological Reports*.

- Sadeh, A., Keinan, G., & Daon, K. (2004). Effects of stress on sleep: the moderating role of coping style. *Health Psychology, 23*(5), 542.
- Schacter, D. L. (1999). The seven sins of memory: Insights from psychology and cognitive neuroscience. *American psychologist, 54*(3), 182.
- Schouwenburg, H. C. (1995). Academic procrastination. In *Procrastination and task avoidance* (pp. 71-96). Springer, Boston, MA.
- Sirois, F. M. (2004). Procrastination and intentions to perform health behaviors: The role of self-efficacy and the consideration of future consequences. *Personality and Individual differences, 37*(1), 115-128.
- Sirois, F. M. (2014). Procrastination and stress: Exploring the role of self-compassion. *Self and Identity, 13*(2), 128-145.
- Sirois, F. M., & Kitner, R. (2015). Less Adaptive or More Maladaptive? A Meta-analytic Investigation of Procrastination and Coping. *European Journal of Personality, 29*(4), 433-444.
- Sirois, F. M., & Pychyl, T. (2013). Procrastination and the priority of short-term mood regulation: Consequences for future self. *Social and personality psychology compass, 7*(2), 115-127.
- Sirois, F. M., & Tosti, N. (2012). Lost in the moment? An investigation of procrastination, mindfulness, and well-being. *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 30*(4), 237-248.
- Sirois, F. M., Melia-Gordon, M. L., & Pychyl, T. A. (2003). "I'll look after my health, later": An investigation of procrastination and health. *Personality and Individual Differences, 35*(5), 1167-1184.

- Sirois, F. M., van Eerde, W., & Argiropoulou, M. I. (2015). Is procrastination related to sleep quality? Testing an application of the procrastination–health model. *Cogent Psychology*, 2(1), 1074776.
- Skeat, W. W. (1884). *An etymological dictionary of the English language*. Clarendon Press.
- Solomon, L. J., & Rothblum, E. (1994). Procrastination Assessment Scale-Students (PASS). Measures for clinical practice, 446-452.
- Solomon, L. J., & Rothblum, E. D. (1984). Academic procrastination: Frequency and cognitive-behavioral correlates. *Journal of Counseling Psychology*, 31(4), 503-509.
<http://dx.doi.org/10.1037/0022-0167.31.4.503>
- Stainton, M., Lay, C. H., & Flett, G. L. (2000). Trait procrastinators and behavior/trait-specific cognitions. *Journal of Social Behavior and Personality*, 15(5), 297.
- Stead, R., Shanahan, M. J., & Neufeld, R. W. (2010). “I’ll go to therapy, eventually”: Procrastination, stress and mental health. *Personality and Individual Differences*, 49(3), 175-180.
- Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological bulletin*, 133(1), 65.
- Steel, P., Brothen, T., & Wambach, C. (2001). Procrastination and personality, performance, and mood. *Personality and individual differences*, 30(1), 95-106.
- Strongman, K. T., & Burt, C. D. (2000). Taking breaks from work: An exploratory inquiry. *The Journal of psychology*, 134(3), 229-242.
- Thatcher, A., Wretschko, G., & Fridjhon, P. (2008). Online flow experiences, problematic Internet use and Internet procrastination. *Computers in Human Behavior*, 24(5), 2236-2254.

- Thomsen, D. K., Mehlsen, M. Y., Christensen, S., & Zachariae, R. (2003). Rumination—relationship with negative mood and sleep quality. *Personality and Individual Differences*, 34(7), 1293-1301.
- Tice, D. M., & Baumeister, R. F. (1997). Longitudinal study of procrastination, performance, stress, and health: The costs and benefits of dawdling. *Psychological science*, 8(6), 454-458.
- Tykocinski, O. E., & Pittman, T. S. (1998). The consequences of doing nothing: Inaction inertia as avoidance of anticipated counterfactual regret. *Journal of personality and social psychology*, 75(3), 607.
- Van Eerde, W. (2000). Procrastination: Self-regulation in initiating aversive goals. *Applied Psychology*, 49(3), 372-389.
- Wang, Q., Chen, W., & Liang, Y. (2011). The effects of social media on college students. Johnson & Wales University, Providence, RI.
- White, V. M., Wearing, A. J., & Hill, D. J. (1994). Is the conflict model of decision making applicable to the decision to be screened for cervical cancer? A field study. *Journal of Behavioral Decision Making*, 7(1), 57-72.
- Wohl, M. J., Pychyl, T. A., & Bennett, S. H. (2010). I forgive myself, now I can study: How self-forgiveness for procrastinating can reduce future procrastination. *Personality and Individual Differences*, 48(7), 803-808.

Do YOU struggle with procrastination?




All participants will be reimbursed for their time with their choice of either a \$10 Westfield Voucher *or* PSYC 105/106 course credit. All participants that stay with the study for the full two weeks and complete all questionnaires will go into the draw to win one of two \$100 Westfield vouchers.

Nikita.dow@pg.canterbury.ac.nz

[illegible]

Appendix B: Questionnaires

All questionnaires were administered using Qualtrics and could be completed on the researcher's PC or the participant's phone. See below for some examples of the Qualtrics formatting.



1.1 The following questionnaire should take an approximate 30 minutes. Please answer all questions.

Participant Number:

Date:

Are you:

☐ Female

☐ Male


☐ Other

What is your age?

0% 100%

Next >>

Survey Powered By Qualtrics



In the last week how frequently did you engage in the following behaviours or thoughts:

Put off the completion of a task?

☐ Not at all

☐ Rarely

☐ Sometimes

☐ Often

☐ All of the time

Allowed yourself to be distracted from your work?

☐ Not at all

☐ Rarely

☐ Sometimes

☐ Often

☐ All of the time

Appendix B-1: Demographic Questions

Completed at baseline only

Participant Number: _____

Date: _____

What is your age? _____

Are you:

- Male
- Female
- Other

Appendix B-2: Pure Procrastination Scale (PPS; Steel 2010)

Completed at baseline only

Please read each question and rate your answers according to the scales below them.

Very Seldom or Not True of Me	Seldom True of Me	Sometimes True of Me	Often True of Me	Very Often True, or True of Me
1	2	3	4	5

1. I delay making decisions until it's too late.
2. Even after I make a decision I delay acting upon it.
3. I waste a lot of time on trivial matters before getting to the final decisions.
4. In preparation for some deadlines, I often waste time by doing others things.
5. Even jobs that require little else except sitting down and doing them, I find that they seldom get done for days.
6. I often find myself performing tasks that I had intended to do days before.
7. I am continually saying "I'll do it tomorrow."
8. I generally delay before starting on work I have to do.
9. I find myself running out of time.
10. I don't get things done on time.
11. I am not very good at meeting deadlines.
12. Putting things off till the last minute has cost me money in the past.

Appendix B-3: Academic Procrastination State Inventory (APSI; Schouwenburg 1995)

Completed at baseline and follow up

In the last week how frequently did you engage in the following behaviours or thoughts?

Not at all	Rarely	Sometimes	Often	All of the Time
1	2	3	4	5
1. Put off the completion of a task				
2. Allowed yourself to be distracted from your work				
3. Gave up studying because you did not feel well				
4. Had no energy to study				
5. Drifted off into daydreams while studying				
6. Had doubts about your own ability				
7. Experienced concentration problems when studying				
8. Gave up when studying was not going well				
9. Doubted that you should have ever taken this course				
10. Interrupted studying for a while in order to do other things				
11. Thought that you had enough time left, so that there was really no need to start studying				
12. Gave up studying in order to do more pleasant things				
13. Studied the subject matter that you had planned to				
14. Felt, when studying that you disliked the subject				
15. Did so many other things that there was insufficient time left for studying				
16. Had panicky feelings while studying				
17. Experienced fear of failure				
18. Felt tense when studying				
19. Wondered why you would study if this would mean so much trouble for you				
20. Felt that you really hated studying				
21. Found the subject matter boring				
22. Forgot to prepare things for studying				
23. Prepared to study at some point in time but did not get any further				

Appendix B-4: Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, and Kupfer, 1989)

Completed at baseline and follow up

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

Please note: These questions and instructions said "month" during the initial administration and "week" during the second administration.

1. During the past month, what time have you usually gone to bed at night?

BED TIME _____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

NUMBER OF MINUTES _____

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME _____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

HOURS OF SLEEP PER NIGHT _____

For each of the remaining questions, check the one best response. Please answer all questions.

Not during the past
month_____

Less than once a
week_____

Once or twice a
week_____

Three or more times
a week_____

5. During the past month, how often have you had trouble sleeping because you . . .

- a) Cannot get to sleep within 30 minutes
- b) Wake up in the middle of the night or early morning
- c) Have to get up to use the bathroom
- d) Cannot breathe comfortably
- f) Feel too cold
- g) Feel too hot
- h) Had bad dreams
- i) Have pain
- j) Other reason(s), please describe:

How often during the past month have you had trouble sleeping because of this?

6. During the past month, how would you rate your sleep quality overall?

Very good_____

Fairly good_____

Fairly bad_____

Very bad_____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at
all____

Only a very slight
problem____

Somewhat of a
problem____

A very big
problem____

Appendix B-5: Perceived Stress Scale (PSS; Cohen, Kamarck, and Mermelstein, 1983)

Completed at baseline and follow up

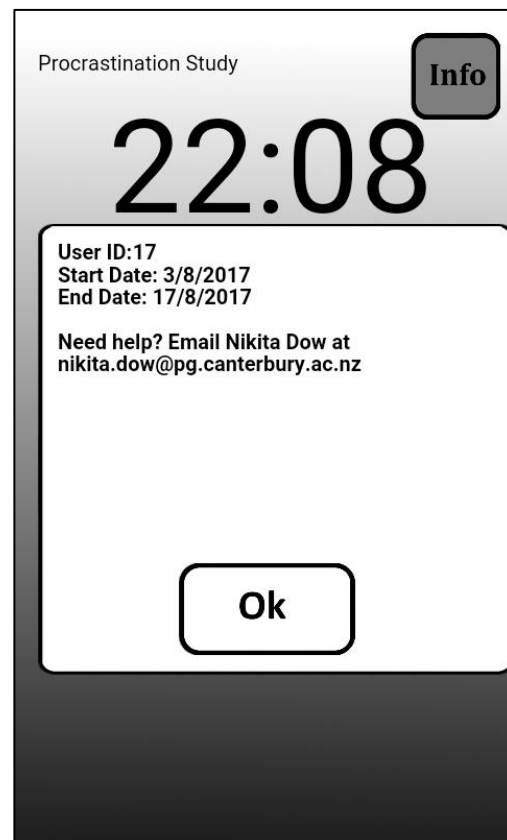
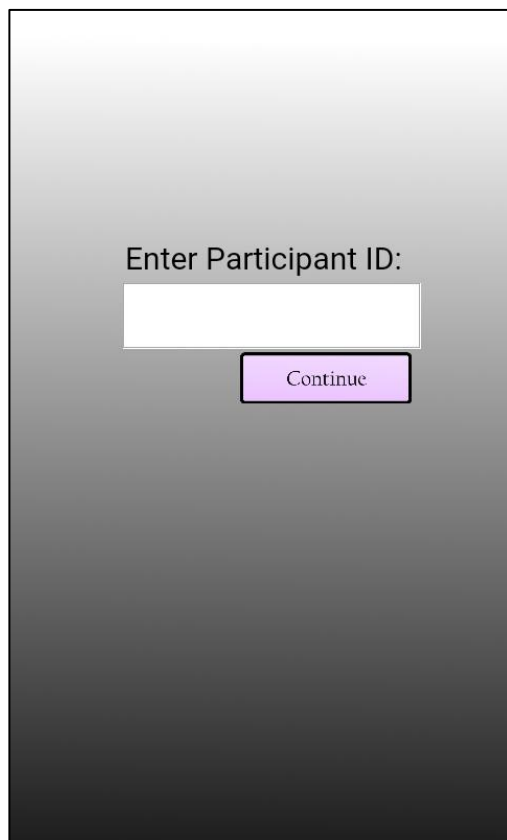
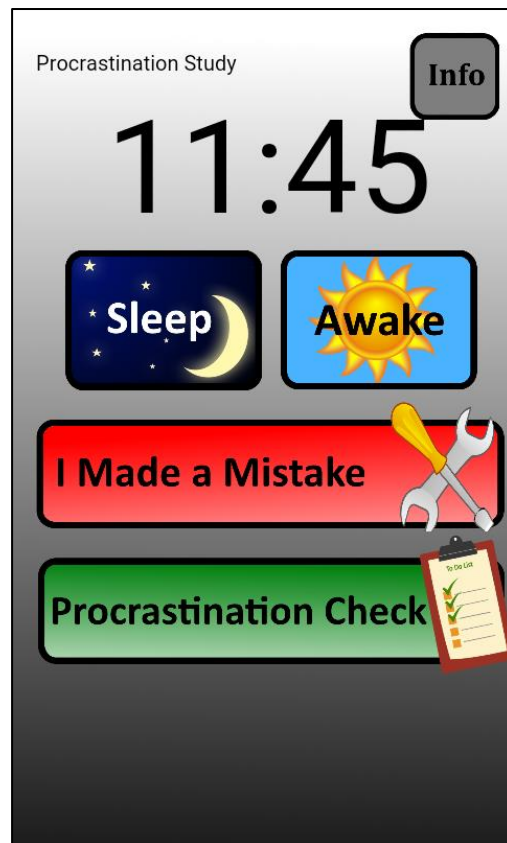
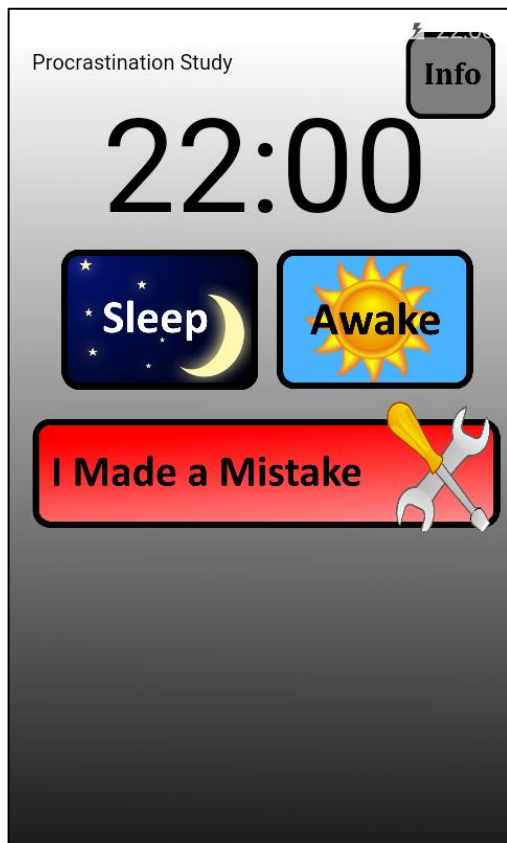
The following 10 questions ask you about your feelings and thoughts during the last month (this question will say “month” when it is initially taken and “week” when it is re-taken). In each case, you will be asked to indicate by selecting how often you felt or thought a certain way.

Never	Almost Never	Sometimes	Fairly Often	Very Often
0	1	2	3	4

In the last month...

1. How often have you been upset because of something that happened unexpectedly?
2. How often have you felt that you were unable to control the important things in your life?
3. How often have you felt nervous or and “stressed”?
4. How often have you felt confident about your ability to handle your personal problems?
5. How often have you felt that things were going your way?
6. How often have you found that you could not cope with all the things that you had to do?
7. How often have you been able to control irritations in your life?
8. How often have you felt that you were on top of things?
9. How often have you felt angered because of things that were outside your control?
10. How often have you felt difficulties were piling up so high that you could not overcome them?

Appendix C: Sleep and Procrastination App Screenshots



Procrastination Study

How would you rate the quality of your sleep last night?

Extremely Bad

Very Bad

Bad

Not Bad / Ok

Good

Very Good

Extremely Good

Continue>>

Procrastination Study - Sleeping

Info

22:00

Sleep Time Recorded

Ok

Procrastination Study - Sleeping

Info

22:00

No awake time recorded. Did you make a mistake?

I am trying to fall asleep again

I made a mistake

Procrastination Study

Info

22:09

No sleep time recorded. Did you make a mistake?

I fell back asleep

I made a mistake

Procrastination Study

What have you done in the last hour?

« Back Continue »

Procrastination Study

On a scale of 1 'Not important' to 7 'Extremely Important', how would you rate the activities you performed in the last hour?

1: Not Important

2: Of Little Importance

3: Not Particularly Important

4: Somewhat Important

5: Important

6: Very Important

7: Extremely Important

« Back Continue »

Procrastination Study

On a scale of 1 'Not urgent' to 7 'Extremely Urgent', how would you rate the activities you performed in the last hour?

1: Not urgent

2: Of little urgency

3: Not particularly urgent

4: Somewhat urgent

5: Urgent

6: Very Urgent

7: Extremely Urgent

« Back Continue »

Procrastination Study

Do you feel that there is anything more important that you should have been doing within the last hour? If so, what was it?

« Back Continue »

Procrastination Study

On a scale of 1 'Not Stressed' to 7 'Extremely Stressed', how are you feeling right now?

<input type="radio"/>	1: Not stressed
<input type="radio"/>	2: Not particularly stressed
<input type="radio"/>	3: Only slightly stressed
<input type="radio"/>	4: Somewhat stressed
<input type="radio"/>	5: Stressed
<input type="radio"/>	6: Very Stressed
<input type="radio"/>	7: Extremely Stressed

« Back

Continue »

Appendix D: Letter of Approval from the Human Ethics Committee



HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2016/113

23 November 2016

Nikita Dow
Psychology
UNIVERSITY OF CANTERBURY

Dear Nikita

The Human Ethics Committee advises that your research proposal "Sleep Hygiene and Procrastination" has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 18th November 2016.

Best wishes for your project.

Yours sincerely

R. Robinson
pp.

Jane Maidment
Chair
University of Canterbury Human Ethics Committee

Appendix E-1: Information Sheet

Psychology Department
Telephone: 027 8232 845
Email: Nikita.Dow@pg.canterbury.ac.nz



Procrastination and Sleep

I'm Nikita Dow and the topic of my Master's thesis is procrastination and sleep. I am looking into the relationships between procrastination and sleep, as well as other factors such as stress and mood. Is less sleep associated with more procrastination? Is too much sleep associated with increased procrastination? Is sleep *quality* a more important factor? Does stress have a role? These are the kinds of questions I am interested in.

If you choose to take part in this study, your involvement in this project will begin with meeting with me and downloading the free Sleep and Procrastination App on your phone. After you have done this I will get you to take an electronic questionnaire on the computer (taking 20-30 minutes). This questionnaire will ask about your general sleep and procrastination habits. I will then explain to you all of the features of the app. You will be using the app to record the times you go to bed and the times you get up- this will be my measure of sleep. The app will also create a pop up notification once daily at a randomized time of day that will ask you six quick questions about your recent activities- this will be my procrastination measure.

Exactly one week from now, you will receive a message from the app which may include some healthy living tips. You are encouraged to follow these tips; however, there will be no penalty if you do not. From this point the app may ask you some brief additional questions every time you indicate you are about to sleep. In total the app should not take up more than 5 minutes of your time daily. Exactly two weeks from when you download it, the App will notify you of your completion of the study and I will send you a link to retake the initial questionnaire you took today. After you have retaken this questionnaire you will receive a \$10 Westfield card for your participation **or** PSYC 106 course credit (PSYC 106 students only). To get your Westfield voucher you may need to come in and see me again (so I can give it to you) however, if you deem this too difficult I am happy to drop it off or send it to you. Please note that you will not receive a voucher if you do not complete **at least half** of the required data. Additionally, if you fill out **all** of the required data, you will go in the draw to win one of two \$100 Westfield Gift cards. All up, your involvement in this study will take about two hours of your time.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data to be returned to you or destroyed. If you withdraw, I will remove all information relating to you. However, once analysis of raw data starts on the 1st of November it will no longer be possible to withdraw your data.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure anonymity and confidentiality, all data you put into the *Sleep and Procrastination App* as well as the questionnaires will be coded under your participant number. I will keep a separate document with your name, participant number and email address. This document will not be shown to anyone outside of the research team and will be saved under the my password protected login on a University of

Canterbury computer. This confidential document will be deleted upon the study's completion after the raffle has been drawn and the winner has been contacted. All other data will be securely stored for 10 years, and will then be destroyed.

A thesis is a public document and will be available through the UC Library, therefore aggregations of the data will be publicly available. Additionally, the researchers and the app programmer will also have access to your raw app data. However, only my supervisor and I will have access to data that could directly identify you.

It is not anticipated that participation in the study will involve any risk to you. However, if during or after your involvement in the study you are concerned about your sleep or stress levels and want to talk to someone, we suggest you contact your general practitioner or the Health Centre on campus. The Health Centre on campus offers counselling services for university students and can be contacted by calling the Student Health Reception on (03) 364 2402 between 8:30 am and 5:00 pm every weekday or by calling into the reception area.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for a Master's of Science degree by Nikita Dow under the supervision of Associate Professor Roeline Kuijer, who can be contacted at roeline.kuijer@canterbury.ac.nz. She will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form. Please ask me if you have any questions about the study.

Appendix E-2: Consent Form

Psychology Department
Telephone: 027 82 32 845
Email: Nikita.Dow@pg.canterbury.ac.nz
25/08/2016



Procrastination and Sleep

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information I provide will be kept confidential by the programmer and the researchers and that any published or reported results will not identify me.
- ☐ I understand that a thesis is a public document and will be available through the UC Library.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after *five* years.
- ☐ I understand that the App programmer may have access to the data I supply to the “Sleep and Procrastination” App but that they will not have access to my identity.
- ☐ I understand that I can have PSYC 106 course credit or a \$10 Westfield gift-card but **not both**.
- ☐ I understand that I will only go into the draw to win the \$100 Westfield voucher if I complete all of the required data.
- ☐ I understand that I can contact the researcher [Nikita Dow; nikita.dow@pg.canterbury.ac.nz] or supervisor [Roeline Kuijer; roeline.kuijer@canterbury.ac.nz] for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)
- ☐ By signing below, I agree to participate in this research project.

Name: _____ Signed: _____ Date: _____

Email address (for report of findings, if applicable): _____

I would like a summary of the results of the project.

Yes

No

Appendix E-3: Debriefing Sheet

Psychology Department
Telephone: 027 8232 845
Email: Nikita.Dow@pg.canterbury.ac.nz



Sleep Hygiene and Procrastination Debriefing Sheet

Thank you for your participation in the Sleep Hygiene and Procrastination study. The aim of this study was to establish a link between poor sleep quality and procrastination, and to see if improved sleep hygiene could improve sleep and procrastination habits in students. To examine this, half of the participants in this study received sleep hygiene education (experimental group) whereas the other half did not (control group).

This project used mild deception in its advertisements and participant information sheets. The advertisements intentionally did not mention “sleep” or refer to this study as a study on “Sleep Hygiene and Procrastination.” Our main concern was that if the study’s true aim was made explicit then the advertisements might have only attracted participants who were procrastinators that *also* had unhealthy sleeping patterns. Likewise, the information sheet did not mention the word “sleep hygiene” and did not say that half of the participants would be receiving sleep hygiene tips. This was to ensure that the control group did not self-educate themselves on sleep hygiene during the study.

If you feel you have been affected by this deception or you are concerned about your sleep or stress levels and want to talk to someone, we suggest you contact your general practitioner or the Health Centre on campus. The Health Centre on campus offers counselling services for university students and can be contacted by calling the Student Health Reception on (03) 364 2402 between 8:30 am and 5:00 pm every weekday or by calling into the reception area.

If you were part of the control group (the group that did not receive any sleep hygiene education), you may request the sleep hygiene tips that were sent to the intervention group (the other group) or an intervention version of the Sleep and Procrastination App.

I would also like to remind you that participation is voluntary and that you may ask for your raw data to be returned to you or destroyed. If you request this, I will remove all information relating to you. However, once analysis of raw data starts on the 1st of October it will no longer be possible to withdraw your data. **You will be notified by email if you win one of the two \$100 Westfield Vouchers** (please note that this draw will not be completed until the end of the year when the last participant has been run).

The project is being carried out as a requirement for a Master’s of Science degree by Nikita Dow under the supervision of Associate Professor Roeline Kuijer, who can be contacted at roeline.kuijer@canterbury.ac.nz. She will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch, (human-ethics@canterbury.ac.nz).

Appendix E-4: App Information Sheet

Tips for using the Procrastinatron App

The image displays two screenshots of the Procrastinatron app interface, each with callout boxes providing instructions for various buttons.

Top Screenshot:

- Info:** Click this to find out your participant no.
- Sleep:** Press this button when you go to sleep. If you are struggling to fall asleep, please keep pressing the "sleep" button every 15 minutes.
- Awake:** Press this button when you wake up. If you fall back to sleep, please keep pressing the "awake" button every 15 minutes.
- I Made a Mistake:** Press this button whenever you make a mistake.
- Procrastination Check:** Press this button **ONLY** after you receive a text from me. It will disappear each day after it is pressed. If you press it accidentally press "back" to avoid the button disappearing. **If you don't receive a text from me by 9pm** and the "Procrastination Check" button is still present, please do a check anyway (if you remember) and send me an email. This should not occur but mistakes happen.

Bottom Screenshot:

- Enter Participant ID:** If this screen appears when you open the app, wait 3 seconds before you input your participant number again. It's likely that it will just disappear.

What time did you go to sleep last night (or whenever the mistake was made).

What time did you wake up this morning (or whenever the mistake was made).

Make sure you describe your mistake in as much detail as possible.

Procrastination Study

What time did you go to sleep?

12:00

What time did you wake up?

12:00

Describe your mistake

« Back Continue »

If your mistake was unrelated to your sleep and/or wake times please just write “xxx” in these boxes.

Answer what you have done in the last hour. You don't have to be too specific if you don't want to e.g. “Was at a personal appointment” but there are also cases where being specific helps e.g. “Was watching pointless Youtube videos”.

Procrastination Study

What have you done in the last hour?

« Back Continue »

Make sure you answer this question and the following questions based off of the hour that occurred directly before you pressed the “Procrastination Check” button.

You may notice that your phone's keyboard covers what you are writing (sorry we have tried, but we cannot fix this). Click back if you didn't mean to press the “Procrastination Check” button.